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INTERNATIONAL CONFERENCE ON ELECTRICAL UNITS.

Although no details have yet been published concerning the conference at Berlin last October between the representatives of different governments on the subject of electrical units, yet we understand that an informal conference was held and that conclusions were reached. This conference, it will be remembered, was called in view of the resolution of the Chamber of Delegates, at the St. Louis International Electrical Congress, to the effect that the difference between the legalized electrical units in different countries were such as to warrant the appointment of an international commission on the subject. We believe that the conference decided in favor of selecting the international ohm in mercury, and the international ampere, determined by the silver coulombmeter as the fundamental primary concrete standard electric units. Also that the Weston cadmium cell containing solid hydrate of cadmium sulphate should be the standard cell, whose e.m.f. should consequently be determined by reference to the primary standard ohm and ampere. Also that an official conference should be called within a year to bring the legalized electric units in accord among the various governments represented.

It was hoped in this country that the two primary fundamental concrete standard units would be the volt and the ohm, because the electrolytically determined ampere involves a process and does not admit of continuous existence or substantial embodiment. However, that is really a matter for physicists to decide upon. The secondary standards of our national laboratories will no doubt consist of alloy-wire ohms, cadmium cells, and electrodynanometer ammeter balances. Our tertiary standards in enginering laboratories will be cadmium or Clark cells and alloy-wire resistance coils. If our standard cells are marked with the same voltage, at standard temperature, to one part in two thousand, and our coils with the same resistance to one part in five thousand, no matter to what national laboratory they are sent for calibration, we believe that the most exacting requirements of the electrical engineer will be fully met for the present.

THE SELF-EXCITING ALTERNATOR.

In a paper presented at the meeting of the American Institute of Electrical Engineers, Mr. E. F. Alexanderson described a form of self-exciting alternator which possesses some interesting features. The machine has a rectifying commutator for supplying unidirectional current to a field winding which differs in no essential manner from that used with separately excited alternators. At the terminals of the field winding is impressed an electromotive force whose value and relative time-phase position varies with the load on the generator and with the power factor of the load current. On page 244 of this issue may be found a description of this machine showing the method by which the three-phase voltage impressed upon the rectifier is obtained by means of the combined actions of auxiliary windings on the stator and series transformers connected in the load circuits.

It is interesting to note that the method which must be employed in order to prevent sparking at the commutator serves

simultaneously to cause the machine to deliver a constant e.m.f. at its terminals. That is to say, the magnetomotive force of the current in an armature at non-inductive load occupies such a mechanical position with reference to the field poles as to shift the resultant air-gap magnetism from the poles, as is well known. When the machine is loaded the shifting of the magnetism causes the voltage in the auxiliary winding to reach its minimum when the rectifier segments have a position with respect to the windings which is different from the position when the machine is without load. Thus, even though the value of the voltage impressed upon the field winding were changed properly with change in load, the machine would not operate properly at non-inductive load without the series transformer, on account of sparking at the brushes. It is evident that this disadvantage would not exist for loads having zero power factor, either lagging or leading, since in such a case the magnetomotive force of the armature current is exerted directly in line with the field poles, and the proper commutating points are not shifted. The method of using the series transformers, as adopted by Mr. Alexanderson, results in shifting the phase position of the voltage impressed upon the rectifying commutator by a number of electrical-time degrees corresponding approximately to the number of electrical-space degrees through which the armature current distorts the field magnetism. The best position of the brushes remains the same for all loads, while the e.m.f. introduced at the rectifier in order to shift the phase of the impressed voltage also acts to increase the field magnetism to a value to cause the generator to overcome the impedance drop in the armature.

The A. I. E. E. Standardization Rules.

The American Institute of Electrical Engineers appointed a committee in 1898 to take up the subject of standardization. The committee made its report in the following year, in the form of a fourteen-page printed pamphlet. The report dealt with the subjects of the classification, efficiency, temperature-elevation, insulation, regulation and rating of dynamo-electric machinery and apparatus. The bulk of the work lay in the definitions and classifications. The questions dealt with were, for example, what and where are the losses of power met with in a given type of dynamo machinery, and how should they be reckoned and computed? It is interesting to observe that no reference is made to a dimension, length, breadth, or size in the entire report, except in a table of sparking distances between needle-points. That is to say, the report excludes all consideration of details of manufacture, and deals only with broad classifications, definitions, or physical conditions. The temptation to a standardizing committee is naturally to work into details, and define the proper proportions of sizes and parts in machines or instruments. Although such dimensional standardization may have value at the date of its preparation, it is apt to hamper and restrict future production, since the forms and proportions of machinery and apparatus tend to change with the natural variations and development of the country, owing to political, economical and technological causes that lie beyond prediction.

The report of the standardization committee was successful from the date of its appearance. Although incomplete and imperfect in detail, it had a marked beneficial influence upon the electric industry. Engineers inserted its clauses in their specifications for machinery, and the manufacturers referred to it in their bids. The effect, in general, was to simplify and standardize machinery, to reduce the number of special orders, to reduce the delay in filling orders, and to reduce the cost of construction. A second edition of the report of the committee, revised and enlarged to twenty-six printed pages, appeared in 1902. The subjects covered in the second edition were the same as those in the first, with the addition of incandescent lamps or luminous sources. Again, there is to be noted a total absence of dimensions or sizes. This edition is in general use among engineers, buyers and manufacturers at the present time. The standardization committee is again engaged in revising and extending the rules to appear in a third edition of the report. The committee is made up of ten members of the Institute, three of whom represent the large manufacturing companies, three occupy university chairs of electrical engineering, one is a professor of electrophysics, one is a consulting engineer, one represents the central stations, and one represents the Bureau of Standards at Washington. It is expected that the new edition of the rules under preparation by the committee will not only revise the existing rules to the present date, but will also include a number of new subjects.

It will be remembered that the Chamber of Delegates of the International Electrical Congress of St. Louis in 1904 recommended that steps should be taken towards international standardization. It is earnestly to be desired that international standardization should be commenced. Of course the task is not easy. It is admittedly difficult to bring about agreement between all interests in electrical engineering—manufacturers, engineers, constructors, purchasers, operators, superintendents—in one country. It is, therefore, yet more difficult to bring about agreement upon the same questions in two or more countries; especially when it is remembered that the methods and customs differ markedly from one country to another, and that interchange of ideas is slow and difficult, when many miles separate different languages. In fact, it is almost hopeless to expect complete agreement between different countries on some of the matters that admit of standardization in each country taken separately. Nevertheless, it is sufficiently evident that there are certain fundamental considerations in connection with dynamo-electric machinery and apparatus which admit of universal standardization, and which when so standardized would doubtless meet with the approval of electrical engineers all over the world. These fundamental considerations may be defined as the essential mechanical or physical limitations of the apparatus, and which are not subject to variation in different countries or in the hands of different manufacturers. For example, the precise definition of the full-load efficiency of a dynamo ought to be the same, and ought to be determined in essentially the same way everywhere. Again, the full-load rating of a dynamo in kilowatts as determined by its temperature elevation, regulation, sparking and overload capacity should be the same everywhere and should be determined in substantially the same way. These propositions commend themselves, we think, to the intelligence of every electrical engineer, in any country. The opposite standpoint is, in fact, not only illogical but ridiculous. Who would recommend, for example, that the full-load rating and full-load efficiency of a dynamo should be variable quantities from country to country, or be functions of latitude and longitude, like the duration of twilight, the frequency of recurrence of the aurora borealis, or the dip of the magnetic needle? We understand that a movement is on foot to initiate international standardization of dynamo electric machinery. We earnestly hope that the movement will suc-

ceed, in the interests of engineering and of civilization. If the movement be confined at the outset to the elementary definitions, mechanical and physical, we believe that it can not fail. The only danger will be in attempting too much at first.

COMPETITION IN CENTRAL STATION WORK.

Whenever in business affairs one examines the adverse conditions that must be met one finds competition in the front rank. Not that competition is always a bad thing—on the contrary it is sometimes a very necessary stimulant; but in a business like that conducted by electric supply stations its effect in deflecting business cannot be neglected, and it is one of the factors which tend to cause the diminished rate of growth to which we have several times of late had occasion to refer. The sales of energy from a central station may be roughly divided into those for lighting and power, grouping under the latter head the miscellaneous uses which do not strictly belong to lighting. The principal profit of most stations is at present in the former branch of its business, and in this it has to face generally stubborn competition from other illuminants, especially from gas. In the early days of electric lighting, say twenty years ago, the electric lamp, whether arc or incandescent, was a novelty and sales were, as in the case of every striking and useful novelty, helped by this very fact. This feature of the early growth of the business has well-nigh disappeared, leaving a competition based in many cases principally upon price. Of course, in his public capacity the central station man pooh-poohs the competition of gas with the brilliant, convenient, hygienic, modern, and universally advantageous incandescent lamp, but in the privacy of his office his characterization of gas competition is not always suitable for publication.

Taking as the unit of comparison the ordinary so-called 16-cp incandescent lamp, originally thus standardized as the equivalent of the legal gas-light, it is easy to see the status of affairs. The ordinary cost to moderate consumers under central station schedules of such an incandescent, including renewals, is from 1 cent to ½ cent per lamp-hour. On dollar gas as a basis, an equal amount of light costs rather less than the lower figure named, without taking mantle burners into the reckoning at all. On the side of the incandescent lamp one has, of course, the familiar virtues of freedom from vitiation of the air, increased steadiness of the light, flexibility in disposition for best illuminating effects, and freedom from the chance of leaking gas. These are all valuable properties which have had a great effect in building up the business of electric lighting. As regards the modest consumer, however, the first advantage has upon the whole small weight. For with a number of burners small with relation to the space concerned, the practical vitiation of the air is not great enough to make a strong impression upon the average man. The steadiness of the light, too, while striking in comparison with a poorly adjusted gas burner, is not at all impressive in comparison with a good gas burner of the Argand variety. The chance of leaks is a more important matter. Gas companies of late are very keen in watching for this trouble and have reduced it to an inconsequential matter so far as the ordinary man is interested. The adaptability of the electric lamp to artistic effect, both in fixtures and in illumination, is one of its greatest competitive advantages, and should always be kept to the fore. But for a very large number of moderate consumers the competition reduces itself almost entirely to a matter of price, and at the present time the gas companies manage generally to retain a small but persistent margin to the good. In dwellings, for instance, the average gas bill is very much less than the average electric lighting bill would be.

When it comes to the next larger class of work the advantages of electric lighting count more heavily, and were it not for mantle burners would be very generally decisive. But while the incandescent lamp has remained at approximately the same efficiency for twenty years, the introduction of the mantle burner has increased the efficiency of gas lighting by some four or five hundred per cent. The lamp-hour from a modern mantle burner costs the consumer, including renewals, something less than 1/10 cent reduced to the same lamp unit as before. To offset this great difference we have a great advantage in the matter of color in behalf of the incandescent lamp and whatever gain may be made in a part of the field by the use of arcs. The common enclosed arc is somewhat but not greatly more efficient as an illuminant than the incandescent lamp, and whatever gain may be made in the matter of cost must depend mainly on a discount scale weighted to favor the arc. As a matter of fact, the mantle burner still retains some of its advantage of cheapness as an indoor illuminant despite the arc. It may be properly held that the discriminating shop keeper ought to prefer the arc or incandescent lamp at any price, that the public ought to be educated and so forth. The answer as practically delivered may be found in any of the less prominent streets of our larger cities. In spite of its bad color and its other disadvantages, the mantle burner has in virtue of its being by far the cheapest common illuminant, taken to itself the cheaper field in increasing measure. Of course, one may very well swell one's chest and proclaim that gas is all very well for the proletariat, but gentlemen should use the latest improvements. Nevertheless the less opulent portions of our cities are growing at a pace that leaves the "best residence districts" far behind, and when the votes are counted the disparity is even more conspicuous.

In the most important business and residence sections electric lighting has a well deserved prominence. It is unquestionably the best means for large illumination, in which quality counts for more than price. Even here, however, there is not freedom from competition, for while gas is at a disadvantage, the isolated electric plant is not to be left out of the reckoning. It is actually a far more serious competitor than is generally suspected, and while it can be discouraged in some instances, it certainly cannot be permanently put out of business save by making prices that most central stations rather hesitate to quote. The gas companies are, for the most part, out of the running at present. They have steadily pursued a policy of nearly flat rates which are low enough to foster the small consumer, although not much modified in favor of the large user. This condition is not likely to be permanent, for a tendency is already obvious toward more liberal discounts for large patrons of the gas plant. How far sheer price will come to count is hard to estimate. Probably much of the important work can never be touched by gas competition directly. Nevertheless, the gas engine running on 50 per cent gas in isolated plants is yet to be reckoned with. To sum up the situation, while the electric central station lighting business is still a great and growing one, it is at present between two fires. The gas companies have, in the past decade, entrenched themselves strongly behind the small and moderate consumer, by making a low base price for their product and by pushing with

great vigor improved illuminants. They have as yet rather neglected the large consumer, in whose case electric lighting has an intrinsic advantage. Meanwhile electric lighting companies have made a high base price for their product and have rather discouraged the small user while gaining by liberal discount a great mass of large work upon which they rely for keeping up their business. Each appears to have tended too far in a particular direction. It behooves the central stations to keep up with every advance in practice that can lessen the price difference between electricity and gas, as well as to keep up their campaign of education as regards quality.

Central Station Business-Getting Systems.

By far the most interesting part of the proceedings of the recent convention at Chicago of the Northwestern Electrical Association was that dealing with central station business-getting methods, an abstract of which appears elsewhere in this issue. The subject is one which is daily attracting more attention among central station men, and there is now promise that before long the reproach that in business methods central stations are not up to date, and that they are far behind their gas competitors, will be removed. We believe, however, that a charge of unprogressiveness against central station men in general is by no means justified. From the technical standpoint our central station companies are, with very few exceptions, wide awake and frequently go beyond their resources in their eagerness to take advantage of new improvements in apparatus. The defect appears to be confined to business-getting methods, and as pointed out by one of the speakers, this is not so much due to lack of appreciation of the importance of this side of central station work as lack of systematic organization for carrying on such work properly. Now that interest is becoming thoroughly awakened, there is a danger that the matter of business-getting organization will be carried to an extreme, and smaller central stations led to adopt methods which require for their proper execution expert service not available on the staff of a small plant. Even in the case of large stations, a business-getting system too elaborate may break down from its own weight. There is particular danger in following proposed systems without due regard to the resources available, and in becoming a mere servant to card files. The card hobby, with its tendency toward emasculation of the personal element and its short-hand treatment of facts, is one to beware of. In brief, a central station should view the problem of business-getting organization as one to be evolved along common-sense lines in accordance not only with the resources, monetary and personal, that are available, but also with local conditions; and in laying out a record and "follow-up" card system, no records of data, however great their intrinsic importance, should be provided for unless they will be specifically utilized in the scheme to which the cards apply.

In the discussion at Chicago to which we refer above, Mr. Almert sketched in detail a business-getting organization which can be safely commended as a guide to central station men who are taking up the matter without previous experience. A few of the details might, however, be modified to suit the case of smaller stations, and to these we shall here refer. We believe it would be well to have a card file specifically for "follow-up" purposes, and a suggestion on this point is given on page 263. This file should include marker cards for interpolation in order to designate, by means of projecting numerals, the date when further attention is required by the card or cards next to a marker. The more important suggestion in mind is, however, with respect to the record of each "prospect." To have this record scattered and consist partly of mere card references, is far from satisfactory, and we doubt if such a system is used extensively in other lines of business in keeping track of prospective customers. When a visit is to be made to a "prospect," or a letter written, the history of the case from the beginning should be at hand in such form that it can be given concentrated attention, and the "file wrapper" system is vastly superior in this respect to the card index and abbreviated reference system.

As generally applied, the wrapper consists of a heavy manila paper (120 lb., 22 in. by 28 in. tag paper, for example) folded once and with the name of the prospective customer written on the upper left-hand folded edge. A sheet cut 9 in. by 12 in. makes, when folded, a convenient sized wrapper which will contain a half sheet of letter paper flat or a full sheet folded once. The wrappers, of course, are filed and handled in the same manner as cards. Information sheets as filed are pasted at the left-hand edge, so that when the wrapper is unfolded its contents can be turned over like the pages of a book. In the case of a present customer, the first enclosure would naturally be a sheet—preferably a printed form—containing the technical data of his installation. In all cases there should be a sheet giving the result of a careful canvass made to determine the requirements of a prospective customer or of extensions that can beneficially be made in the installation of a present customer. When a personal letter is written a carbon copy on thin paper is inserted, being trimmed if it thereby can be inserted unfolded in the wrapper. Since the "follow-up" card file will contain a record of form letters, these need only be inserted in the file wrapper should they have some definite connection with the history of the case.

With such a system it will be seen that prior to making a visit a solicitor may make himself absolutely thoroughly informed concerning the entire history of a "prospect," and the information will come under his eyes in a manner to make upon his mind a much stronger impression than would be conveyed if he had to seek through files and decipher cabalistic card notations. Perhaps even a greater advantage in many instances would be that in case of a change of solicitors a new man can in a few minutes take up the thread of any unfinished case. From the discussion in Chicago it appears probable that a practice will grow up whereby smaller central stations can secure at intervals for short periods the services of an expert solicitor. The "file wrapper" record would be ideal in such cases, not only for giving the station a permanent record of the work of transient solicitors, but also through the entire history right up to date, of prospects being thus at the disposal of an expert solicitor when one is engaged.

Reducing the Number of Overhead Lines.

In the article elsewhere in this issue on the plant at Springfield, Ill., some useful pointers are given as to the way in which the central station company there has attempted to decrease the number of wires carried on overhead pole lines in the downtown district. The hints given are especially useful to companies operating in cities of such size that there is beginning to be talk of placing all wires underground in the business district. On account of their number, telephone wires are usually first to be placed underground. Electric light and power companies can put off the evil day for some time by observing simplicity and neatness in overhead work. In the case at Springfield most of the transformers and secondary mains are located in alleys.

For the sake of simplicity, two-wire secondary distribution instead of three-wire has been adopted. The heavy secondary mains which usually are the most conspicuous on a pole line are run along the rear walls of buildings so that the service conductors for each building can be connected to them without running wires across the alley. The arrangement does away with the most unsightly part of electric light and power distributing circuits, namely the customer's service wires radiating from various poles in the alley to the different customers. By using good, substantial bracket construction along the buildings for the secondary mains with strong head guys at each end, the advantages of the plan in such cases as outlined appear to outweigh far any possible disadvantages of having mains supported on the buildings.

STATIONS THAT HAVE "NEVER PAID."

It would be interesting to know how many of the small central station companies of the country that have never paid a dividend are similar to one which recently came to our notice. The plant, which was serving a population of about 4,500, was apparently in an unusually prosperous and well-managed condition and had been growing rapidly ever since starting. The manager remarked that the plant had "never paid," which seemed like a rather startling assertion and called for further inquiry. It then appeared that while the company was originally organized with a small capital, no money had been either taken out or put in by the investors since it started, and that the total amount now invested in the plant is about 2½ times that originally put in. In other words, the reason that the plant has not paid is that the dividends have all gone back into the property in the shape of enlargements and improvements, and the stockholders have now a plant worth very much more than when they started. There are plenty such properties throughout the country, both in central station and matufacturing business. It has been the history of central station business throughout the country that the growth has been beyond anything the original stockholders anticipated and it has been a question of buying from time to time new machinery and apparatus or go out of business. A little closer analysis of what constitutes maintenance and renewals and what enlargements and improvements would put investments in electric lighting companies in the smaller towns in a somewhat different light before the local stockholders. The condition described is entirely a healthy one, and it is to be wished that it existed in some of the cities where extremely opposite tactics have been pursued and where not only new construction but maintenance and renewals have been charged to capital account.

THE ELECTRIC FLAT-IRON.

The electric flat-iron seems certainly to have come to stay as a steady source of central station income. From all over the country come reports of remarkable success in the introduction of this most generally used of electric heating appliances. The results mentioned in articles elsewhere in this issue following the introduction of the flat-iron in Belvidere, Ill., and Dubuque, Iowa, while unusually good in that so many irons were placed at the start, can, we believe, be duplicated in many other places if only the matter is taken up in the right way. Beyond question the electric flat-iron is its own best salesman. The main point is to get it into the hands of users for trial and sending them out on 30 to 60 days trial appears to be the best way of accomplishing this. While the electric iron costs more to operate than the older and more familiar types, just as unquestionably no user of electric light who can possibly afford it will go back to gas or kerosene, so no one who has used the electric flat iron wants to go back to gas or coal heated irons. People are willing to pay a good price for the sake of convenience and cleanliness, and there is in the electric flat-iron also a considerable element of time saving compared with other irons. This has been demonstrated in factories where ironing is done by piece work and where the output with electric irons has materially increased. For the most rapid introduction of the flat-iron, spring and summer are, of course, the best times. The latter part of the summer there are a certain number of people who will put the matter off until spring. Now is the time to get ready for a spring flat-iron campaign.

GROUNDING OF SECONDARY CIRCUITS.

While it is to be regretted that the late revision of the National Electrical Code does not frankly make mandatory the grounding of secondary circuits, a step in advance is the permission given to inspectors to do so. Grounding furnishes the only feasible method of making inside wiring entirely safe and free from dangerous conditions due to crosses with high-tension lines either on outside lines or inside transformers. Usually such crosses occur inside a transformer as a result of lightning, and they frequently remain undiscovered until the presence of the defective transformer is made known by a severe shock or perhaps a fatal accident to some one handling the wires or sockets inside of a building on the secondary circuit. Probably the great majority of smaller central station companies of this country have as yet failed to take this precaution of the grounding of secondary circuits. Only recently a small company operating in a country village had to pay several thousand dollars damages on a fatality caused entirely by the failure to ground a secondary circuit. Leaving aside for a moment all considerations of humanity, a payment of several thousand dollars in damages makes a big hole in the net earnings of a small company, and yet a company is simply inviting this sort of thing as long as it neglects to take the precautions which insure absolutely against it.

The effective grounding of secondary circuits need not by any means be a tedious or expensive operation, as set forth in the specifications in the revised National Electrical Code, printed in our first issue of the year. The detail which interests the smaller companies most, however, is an inexpensive and effective method of grounding at the base of poles upon which transformers are located and near which no good water pipe ground is usually available. For such grounds the large, buried copper plate suggested by the National Code rules, although effective if properly buried, is rather costly and requires considerable labor in excavating a place for it. One large company, which has given the matter of grounding such transformers a great deal of thought, and which maintains a high standard of construction in all respects, has found that a piece of 1-in. galvanized iron pipe 10 ft. long, driven into the ground at the base of a pole, will afford fully as good a ground as a copper plate, and at less expense. Such a pipe can be driven into the ground by the line gang and the ground wire soldered to it in a very short time. The ground wire to be soldered into the pipe is coiled in a spiral which will fit into the top of the pipe and then sweated in with solder, an asbestos paper plug having been inserted just below the spiral, to hold the solder. Although it may be some time before the underwriters will actually insist upon the grounding of secondary circuits in all the smaller villages of the country, it is not to the interest of any central station company to wait until that time comes before so doing.

Important Understanding in Lamp Litigation.

Mr. A. W. W. Miller, president of the American Electric Company, of New Jersey, and of its associated Missouri American Electric Company, of St. Louis, has issued an important announcement to the electric lighting industry and the electrical trade as to recent results connected with the litigation of which note has been made in these pages. We quote as follows:

"An understanding having been arrived at between the General Electric Company, a corporation of New York, the Edison Electric Light Company, a corporation of New York, and the American Electric Company, a corporation of New Jersey, and the Missouri American Electric Company, a corporation of Missouri, relative to the patent litigation against the Missouri American Electric Company, such arrangement being satisfactory to all the parties in interest, we have pleasure in announcing to users of and dealers in the incandescent electric lamps made and sold by us; that:

"All such litigation between the parties has been terminated; and that the American Electric Company of New Jersey and the Missouri American Electric Company of St. Louis, Missouri, have the legal and undisputed right, to the use of all patents on which monopoly is claimed by the National Association of Licensed Manufacturers of incandescent lamps; consequently there can be no interference with dealers in or users of our lamps."

In regard to this Mr. Miller says: "The proposed settlement with the General Electric Company has been fully consummated by an interchange of patents by which the General Electric Company dismiss all suits against this company at their cost, and give us a free license for the use of all the patents by which the 'combination' is kept together without restriction or responsibility of any sort or kind to them in the use of same." At the same time, Mr. Miller remarks, this leaves them free from "entangling alliances," while ensuring independence and freedom from molestation.

Annual Meeting and Dinner of the Chicago Electrical Trades Association.

The Electrical Trades Association of Chicago held its annual meeting and dinner during the last week of the Chicago Electrical Show, January 24. The place selected was the second floor of the Coliseum Annex adjoining the show. The meeting combined a business session and dinner. The secretary's report showed the membership in the Chicago association to be 155 manufacturers and jobbers, and the total membership in the allied associations of Boston, New York, Philadelphia, San Francisco, Montreal and Chicago to be 355. One hundred and twenty-five manufacturers and jobbers were present at the dinner. These included not only local Chicago trade representatives but men from all over the western and southern states and visitors from the East. The association as is well known is one formed ten years ago to put the matter of credits in the electrical retail trade on a more satisfactory footing, and weed out "dead beats." A number of reports were given from various members bearing testimony to the benefit derived from membership in the association, both in collection of bad accounts and the avoidance of them. In the absence of the president, Mr. E. R. Gilmore, and vice-president, Mr. Seymour Cuthrie, the secretary, Mr. Frederick P. Vose, was made chairman of the business meeting. After the reports of several committees, the election of officers was held with the following result:

Mr. Frank Beardslee, of the Beardslee Chandelier Mfg. Company, president; Mr. Seymour Guthrie, Kellogg Switchboard & Supply Company, vice-president; members of the executive committee: Mr. Thomas I. Stacey, Electric Appliance Company; Mr. E. R. Gilmore, Western Electric Company, and Mr. S. E. Kennedy, Central Electric Company. Mr. James Wolff was reappointed member on the National Board.

After the business meeting which immediately followed the dinner, Mr. James Wolff, of the New York Insulated Wire Company, took charge as toastmaster, and the following responded to toasts: Mr. Charles W. Wilkins, Partrick, Carter & Wilkins, Philadelphia, the founder of the association, spoke most happily and gave expression to his well known conviction as to the efficacy and thorough practicability of the Electrical Trades Association co-operative plan of credit protection, which he regards as one of the most important features in the electrical industry to-day. The other gentlemen on the program were Mr. Frank M. Pierce, Manhattan Electrical Supply Co.; Mr. F. B. Uhrig, Western Electric Company, Kansas City; Mr. Conover, the John A. Roebling Sons Company; Mr. Charles E. Gregory, Guarantee Electric Company; Mr. W. E. Phelps, the Phelps Company; Mr. Henry L. Walker, Detroit; Mr. J. E. Erner, the Erner Electric Company, Cleveland; Mr. S. S. Kennedy, Central Electric Co.; Mr. Harry Parsons, Western Electric Company, Chicago; Mr. Thomas R. Mercein, Milwaukee; Mr. Sisson, of the D. & W. Fuse Company, Providence.

A Proposed Institute Trip.

The following circular has been issued to the membership of the American Institute of Electrical Engineers by the secretary: "The Board of Directors has received from the Institution of Electrical Engineers of Great Britain a cordial invitation to the American Institute of Electrical Engineers to visit England during the latter part of June next. A similar invitation has been received from the Associazione Elettrotecnica Italiana, to visit Italy during the season of the Industrial Exhibition at Milan beginning May 1, 1906.

"These invitations are in acknowledgment of the courtesies extended to both organizations by the A. I. E. E. It will be remembered that large representative bodies from both these societies took part in the Circular tour, on the occasion of the International Electrical Congress at St. Louis, September, 1904, and participated in a joint meeting at St. Louis.

"Both of the proposed tours will embrace visits to important electrical plants, educational centers, and scenic features of these countries. The Italian trip would necessarily either immediately precede or follow the visit to England, in all probability during the month of May. The time of year precludes the possibility of making special arrangements for transportation in advance, and it will probably be necessary to depend upon individual arrangements for the transatlantic trip. The cost of the trip should, therefore, be estimated by the individual in accordance with his preference as to steamship line, return trip, etc.

"The proposed tour, if organized, will not take the place of the regular annual convention, which will be held as already proposed in a city of the Central West, June 26-29.

"The Board of Directors desires to obtain at the earliest possible moment an expression of opinion as to your participation either in one or both of the proposed visits."

Members are asked to notify the secretary as to their intentions touching this courteous invitation from abroad. The annual meeting of the Institute will, it is rumored, be held in a Western city, probably Milwaukee or Detroit.

The Question of Municipal Lighting Ownership in Boston.

In response to the request of Mayor Fitzgerald for a statement as to the existing provisions of law applicable to the establishment of a municipal lighting plant by the city of Boston, Corporation Counsel Babson submitted to the Common Council at its last meeting a most important opinion, covering the obligations of the city in the matter as well. No action was taken on the municipal lighting order and the corporation counsel's opinion was printed as a public document. We give the opinion below:

I am requested by you to transmit to the Common Council a full statement of the existing provisions of law applicable to the establishment by the city of Boston of a municipal gas and electric lighting plant and the obligations of the city in that event to purchase the property of the existing gas and electric lighting companies in the city, together with a statement of what property and franchises, if any, must be included in such purchase, the amounts necessary to pay therefor, the method of determining such amounts, the means and methods of paying the same, in-

cluding the issue of bonds and the extent and legality of such issue, and any further information which in my judgment may be of value to the Common Council in acting upon the proposition before it.

The provisions of law applicable to the matter are contained in Chapter 34 of the Revised Laws as amended by Chapter 410 of the Acts of 1905. This chapter is in substance an act prohibiting a city or town from establishing a gas or electric light plant unless it buys the plants already existing within its corporate limits at a price to be fixed by the courts if the companies offer to sell. Section 2 of the act provides that a city shall not acquire such a plant until it is authorized by a vote of two-thirds of each branch of its city council passed in each of two consecutive municipal years and thereafter ratified by a majority of the voters at an annual or special city election.

If the second vote required by Section 2 of Chapter 34 has once been passed and approved by the Mayor and has been ratified at a city election the city is definitely committed and cannot thereafter rescind its action, no matter how unwise or impracticable under existing laws and conditions the undertaking may thereafter be found to be.—Hudson Electric Light Company vs. Hudson, 163 Mass., 346.

The passage of the second vote and its ratification by the voters will, under the law as it now stands, compel the city to purchase at their fair value those portions of the plants of the Edison Electric Illuminating Company, the Boston Consolidated Gas Company, the Charlestown Gas & Electric Company, and the East Boston Gas Company, lying within the city limits, and to pay damages for the severance of those portions of the plants lying outside the city limits, without any right on the part of the city to own the outlying portions of the plants.

By Section 13 of Chapter 34, Revised Laws, a city is authorized to purchase such outlying plants, but by Section 16 the right of such city to buy outlying plants shall cease unless the City Council, within 60 days after the filing of the schedules required by Section 15, votes that such purchase shall include the outlying property. Schedules were filed by the several gas and electric companies in accordance with Section 15 on August 24, 1905, and, as the City Council failed to pass the vote required by Section 16 within 60 days thereafter, the city has lost the right to acquire anything but those portions of the gas and electric plants which are within the city limits.

Very substantial parts of the plants of the Edison Company, the Consolidated Gas Company and the Charlestown Gas Company lie outside the city limits. The values claimed by these companies for the outlying properties in the schedules filed by them are in the case of the Edison Company $1,792,000; Consolidated Gas Company $3,346,000; Charlestown Gas Company, $300,870; total, $5,438,870.

By reason of the failure to pass the vote mentioned in Section 16 the city might be compelled to pay substantially the value of the entire gas and electric lighting plants owned by these companies and the East Boston Gas Company, by way of damages, although it can acquire only that portion of the plants in the city of Boston.

The property of the Boston Consolidated Gas Company is located not only in Boston, but also in Brookline, Milton, Chelsea, Somerville, Cambridge, Newton, Watertown and Everett. These properties are all connected, and in the case of many of the large mains in Cambridge and Somerville and Everett, to disconnect them from the rest of the plant would not only destroy their value, but would damage the portion of the plant in the city of Boston by taking away connections which are essential to the operation of every part of the plant.

The price to be paid by the city for the property and plants of the companies is its fair market value for the purpose of its use. This has been interpreted by the courts to mean its value as a going plant. The amounts claimed by the several companies who have complied with the law are as follows:

Edison Electric Illuminating Company	$26,500,000
Bonds and notes of Edison Company to be assumed	1,325,000
Boston Consolidated Gas Company	26,902,700
Charlestown Gas & Electric Light Company	2,075,130
East Boston Gas Company	700,000
Total	$57,502,830

In addition to this sum, which the companies claim by their schedules to be the value of their plants within the city limits, there is their claim for damages to the outlying plants amounting to $5,438,870.

The Edison Electric Illuminating Company has stations outside of Boston located in the following cities and towns: Somerville, Woburn, Milton, Dedham, Natick, Framingham and Canton. It also has distributing apparatus with property in 12 other places. In all the company has property located in four cities and 22 towns.

It is impossible to estimate how much of the $62,000,000 claimed by these companies would be allowed by the courts. If, for the sake of argument, we say that the companies would recover $52,000,000 of the $62,000,000 claimed, then this peculiar condition would arise: The ratification of the second vote of the City Council by the voters at a city election is a purchase under the act. The provisions for the payment of the purchase money appear in Sections 7 and 8 of said Chapter 34, and bonds may be issued for that purpose outside the debt limit, provided the whole amount of bonds so issued shall not at par exceed 2½ per cent of the valuation of the city, according to the last preceding State valuation. The aggregate State valuation on the city of Boston on May 1, 1904—the last to which I have access—was $1,237,038,351. Two and one-half per cent of this is a little under $31,000,000. So that the total amount of bonds which the city can issue for the purpose of paying for the property of the four corporations mentioned and for damages to their out-of-town plants and for additions which would be necessary could not exceed $31,000,000.

If we adopt the supposition (of course, a mere guess) that the companies could recover only $50,000,000 of the $62,000,000 which they claim, then the peculiar condition would arise that the city had voted to expend $50,000,000 and could only raise $31,000,000 to pay for the purchase.

The Edison plant at South Boston is reported to have enormous generating capacity. It is said to have been laid out and constructed with the idea of generating enough kilowatts of electricity to supply lighting facilities not only for Boston, but for the metropolitan district and beyond. The Edison Company supplies electricity from this station to the consumers in the territory extending from Framingham to the end of South Boston point. If the city desired to purchase this plant it is to be regretted that it did not exercise its right to purchase the staions and conduits outside the city limits, as the South Boston plant is apparently more extensive than is needed to supply electricity for the city proper.

The same may be said in a less degree of some of the properties of the Consolidated Gas Company. The Brookline plant, for instance, is situated in both Brighton and Brookline. It furnishes both gas and electricity. Its pipes, mains and conduits extend through the whole of Brookline and large portions of the city of Boston. If we purchase only the part situated within the city limits, which is all we can do now, we divide the property in such a way as to materially injure both the part that we acquire and the part which is left to the company.

Under the provisions of Chapter 34 of the Revised Laws, Section 15, the Mayor, committees of the City Council and experts employed by the city to determine the value of the plants offered for sale were authorized to examine the property and report upon its value and the desirability of its purchase. As far as I am informed, nothing of the kind has been done by the Mayor, committees of the City Council or experts employed by the city. If the street or fire department were going to purchase a horse of the value of $200 the department, before purchasing, would have an expert examine as to the soundness of the horse and its market value. The city seems to be drifting toward the time of taking votes which will make a purchase of property (forming the most important financial proposition ever brought before an American city) without any attempt to ascertain the market value of the property which it proposes to purchase or its earning capacity.

Inquiry is made of me as to the amount which may be necessary to pay for these properties. Although quite familiar with the plants of the Boston Consolidated Gas Company, I have never

examined the plant of the Edison Electric Illuminating Company or those of the Charlestown and East Boston Gas Companies, and, not being an expert, my opinion would be of little or no value. There are ways open to the City Council to get the opinions of experts on the subject under Section 15 of Chapter 34 of the Revised Laws.

Electrical Engineers of the Times.

MR. J. E. WOODWELL.

Julian E. Woodwell was born at Wells, Me., January 7, 1874, and is the oldest of five sons of the Rev. William H. Woodwell of the Congregational Church. He graduated from the high-school of Sandwich, Mass., in 1890, and later from the high-school of Newburyport of the same state. Entering the Massachusetts Institute of Technology, he was graduated from the Department of Mechanical Engineering in 1896, the youngest member of his class. He took courses of study outside the prescribed curriculum of the Mechanical Engineering Department, including theoretical electricity and other subjects in the electrical engineering course.

Immediately upon graduation Mr. Woodwell's services were engaged as assistant to Prof. S. H. Woodbridge of the Massachusetts Institute of Technology in the preparation of plans under

MR. J. E. WOODWELL.

Government direction for the renovation of the method of ventilating and warming of the Senate Chamber and the Senate wing of the U. S. Capitol, and also in the drafting of plans for the heating and ventilation of the South Terminal Station, Boston, upon which works he was engaged for a year. In February, 1898, Mr. Woodwell began his Government service, having passed with credit the civil service examination for the position of electrical draughtsman, U. S. Treasury Department. In July of the following year he was appointed inspector of electric light plants in the same department, which position he still holds. This office exercises general electrical supervision over the operation of the electrical and mechanical equipment of about 360 Federal post-office, custom house and sub-treasury buildings under control of the Treasury Department. An officer of that department is authority for the statement that the economies brought about by the administration of this office have resulted in annual savings which have probably passed the $100,000 mark. Congress has on two occasions recognized the value of the office by increasing the salary of the position and by appointing an assistant inspector.

Among the more strictly professional work done by Mr. Woodwell in connection with his present service are included the installation of systems of electric wiring and fixtures in more than 75 buildings, and complete electric power plants in ten of the larger of these buildings. Fifteen buildings have been equipped with isolated electric generating plants operated under the technical supervision of Mr. Woodwell's office, which also attends to the purchase of engineering supplies for all the buildings named, and to the making of contracts for light, heat and power service with private companies.

Outside the regular duties of his office Mr. Woodwell has prepared plans for the central heating and lighting plant now in operation in the Patent Office, Old Post-Office and Pension Office group of buildings in the Interior Department. He has rendered assistance in the preparation of a recent report to Congress relative to the proposed central power, lighting and heating plant for the Executive Department Buildings, and is now in associate charge of designing plans for the electrical and power equipment of the new National Museum Building and for the Onondaga County Court House, Syracuse, N. Y.

Mr. Woodwell is a member of the American Society of Mechanical Engineers and of the Society of Arts, Boston.

CURRENT NEWS AND NOTES.

CIVIL SERVICE.—The New York State Civil Service Commission will hold examinations on February 17 for a number of positions, including that of assistant electrical engineer; and a telephone operator for the New York County offices at $720 a year. Application forms can be secured by addressing the Commission, offices at Albany, N. Y.

HYDROGRAPHIC SURVEY.—The distribution of river stations by the Government hydrographic investigation at the present time is as follows: Twenty in Maine, 12 in New Hampshire, two in Vermont, six in Massachusetts, one in Rhode Island and two in Connecticut. There are, moreover, some 15 important stations on rivers in New England, where observations and reports on water flow are prepared by private parties, many of whom are interested in plans for hydro-electric development.

SONS OF JOVE.—The "Sons of Jove" held their "Rejuvenation," in Chicago, on the evening of January 25, when a number of Chicago electrical men were initiated into the order. The members appeared in parade on the floor of the Coliseum about 9 p. m. clad in the bright red hood and gown of the order, led by a herald and by Jupiter in the person of Mr. Charles A. Newcomb, of Houston, Tex. Following the Jovian members were a string of blindfolded new members to be initiated tied to a long rope. The parade wound up at the annex where the initiation and banquet followed.

THE EDISON MEDAL.—The Edison Medal Committee of the American Institute of Electrical Engineers, Mr. John W. Howell, chairman, has just issued a circular to the educational institutions of the United States, calling their attention to the fact that funds are available for the award of the medal this year and pointing out the conditions under which students can enter in competition for it. This will be the first award of the medal, and it is hoped that there will be many contestants for the honor. It is suggested that institutions of learning not already on the competitive list should make application for the necessary data and forms.

BELL AND BRANTFORD.—The city of Brantford, Canada, has, it is said, determined to set a good example to those cities that wait to honor a distinguished son until he is dead. The town's recognition of Alexander Graham Bell's services to humanity in inventing the telephone will take the shape of a memorial to be erected some time this year. To arrange details a committee has been formed. It has been suggested that the old Bell property at Brantford should be bought and maintained as a park. Dr. Bell's father went from Edinburgh to Brantford in 1870 and some of the very earliest experiments of a telephonic nature by Bell are said to have been made from his father's house to that of the Rev. T. Henderson in June, 1875. The idea has been suggested that Dr. Bell might present the homestead to the city for park purposes, but of course this would not carry out the idea of the citizens in seeking to honor him.

A LEIBNITZ MEDAL.—The Emperor William of Germany celebrated his forty-seventh birthday on January 27. In honor of the birthday a Leibnitz Medal has been established to be awarded annually by the Academy of Science for notable scientific achievements.

CONTROL OF CITY SUBWAYS.—A meeting was held last week in New York City at the call of the transit committee of the New York Board of Trade and Transportation, when it was voted by the representatives of thirty-one organizations in attendance to present to the mayor, the rapid transit commission and the board of estimate and apportionment a memorial to the effect that it is essential that effective city control over lines of subway to be built in the future should be reserved. It was also voted to hold another meeting to take steps to secure a permanent organization, in which all of the boroughs of the city will be represented, to work for the obtaining of better transportation service throughout the city.

TITLES BY TELEPHONE.—In an article in the February *World's Work*, Mr. W. G. Fitzgerald says: "One of Herr von Bülow's principal achievements as State Secretary for Foreign Affairs was the conclusion of the affair with Spain regarding the groups of the Caroline, Pelew and Marianne Islands, which gave great satisfaction to the Emperor and resulted in the promotion of the Secretary to the rank of count. The promotion took place in a typically modern way. The news of the termination of the South Sea trouble was telephoned by the Secretary to a high officer of the imperial household at the palace in Potsdam, some sixteen miles away. Five minutes later, the telephone in von Bülow's study rang, and the same officer said, "I am ordered to inform Your Excellency that His Majesty confers upon you the title and dignity of a count of the German Empire!"

ELECTRIC LIGHT FRANCHISES IN NEW JERSEY.—A bill has been introduced in the New Jersey State Legislature requiring that all new franchises or expiring franchises of public utility corporations shall be put up for competition and awarded to the best advantage of the municipality concerned. A successful competitor must pay to the holder of an expiring franchise the appraised value of property. All franchises are to be limited to 25 years in cities of the first and second class, and 50 years in other parts of the state. Another act introduced provides for condemnation proceedings whereby municipalities may acquire existing electric lighting plants, and authorizes cities to issue bonds to build and operate new electric lighting plants. A resolution must be passed by a city governing body setting forth that it is its intention to erect an electric lighting plant; an electrical engineer shall then be employed to make plans and prepare estimates. The bill allows the sale of power to public and private concerns and to adjacent municipalities.

TRANSFORMATION FROM THREE-PHASE TO SINGLE-PHASE.—In a recent issue of The *Electric Journal*, Mr. C. F. Scott discusses the operation of a single-phase circuit from a three-phase generator, and shows that the phases of the polyphase generator must, in any event, be badly unbalanced. In a normally operating symmetrical three-phase system, the flow of energy is uniform. It is comparable mechanically to the continuous flow of energy through the instrumentality of a belt. The single-phase system, on the other hand, has as its characteristic an intermittent flow of energy. It is, therefore, impossible to convert from three-phase to single-phase and continue the normal operation in both systems unless there be some provision for storage of energy, such, for example, as a rotating armature, which may be driven by a three-phase current and deliver single-phase current. Such a means of storing energy is not found in ordinary transformers. "The foregoing consideration is a conclusive answer to the proposition that single-phase power can be taken by means of ordinary static transformers from a three-phase system without unbalance."

PRICE OF CURRENT.—In the New York Legislature, Senator Page has introduced a bill providing corporations furnishing or selling electricity in New York City shall not receive in excess of 10 cents per kilowatt hour, the act to take effect July 1, 1906. Senator Desher has introduced a bill to reduce the price of electric lighting in Brooklyn to public and private consumers to correspond with the prices charged on Manhattan Island.

MASSACHUSETTS TROLLEYS.—To the railroad commissioners of Massachusetts the street railways report an added mileage during 1905 of about twenty-five miles. With new second track and sidings added its total is some fifty miles. The increase in expenses was $280,000; earnings increased about $879,000; passengers carried 532,731,017, an increase of 12,374,000 over 1904. Eighty-five persons were killed in accidents, eighteen passengers, thirteen employees and fifty-four other persons.

TUNNEL ON THE PENNSYLVANIA.—The famous Horseshoe Curve on the Pennsylvania Railroad, which is one of the scenic features along that line, is, according to a Pittsburg dispatch, to give way to a more direct cut-off. The plans which will probably be adopted call for a tunnel 9 miles long under the Allegheny Mountains. The tunnel will provide for four tracks and it is said that electric power will be used in conducting traffic operations. The cost of the tunnel and making the connections with the main line is estimated at over $15,000,000.

WESTERN SOCIETY ELECTION.—The electrical section of the Western Society of Engineers, Chicago, held a meeting for the discussion of "Cars for City Street Railway Service," on January 26. Mr. M. B. Starring, general manager of the Chicago City Railway Company, was the principal speaker. Officers for the section for 1906 were elected as follows: Chairman, Mr. S. G. McMeen, consulting telephone engineer; vice-chairman, Mr. Peter Junkersfeld, of the Chicago Edison Company; member of executive committee, Mr. Otto E. Osthoff, of H. M. Byllesby & Co.

MUNICIPALISM IN BOSTON.—The directors of the Boston Merchants' Association, at a special meeting called to act upon the matter of municipal ownership of a lighting plant last week put themselves on record as opposed to the project. The secretary read the statement of Corporation Counsel Babson recently forwarded to Mayor Fitzgerald on the subject. It was shown that in the event of the plans being taken over by the city the total damages claimed would be practically $60,000,000, involving on the part of the city about $3,000,000 annually to meet new obligations and to make up its loss of revenue in taxes.

BIG GAS CONSUMPTION.—Mr. Walter R. Addicks, acting president of the New York Consolidated Gas Company, who was before the Gas Commission, gave figures to show what the consumption of gas sold by the company in 1910 would be. After making the calculations by many different methods be prophesied that the sales in that year would amount to some 15,250,000,000 cu. ft. On the average, every inhabitant of the Borough of Manhattan uses 6,274 cu. ft. of gas made by the Consolidated Gas Company. This figure is arrived at by dividing the total output for last year by the population of Manhattan as given in the census of 1905.

THE FIRST ELECTRIC MOTOR.—An item current in the New England papers and quoted below from the Boston *Transcript*, is as follows: "Although unknown as an inventor and almost blind and heavily weighted with his 86 years, Wareham F. Chase invented 50 years ago the first electric motor, the model of which is now in the Vermont State House. The model will run to-day when an electric current is applied, as it did half a century ago in his shop in Montpelier." Considering that Thomas Davenport, the Vermont blacksmith, built his famous motor in 1836-7, it will be seen that Mr. Chase, while a pioneer, was very far from "first." Indeed, Davenport's work dates back crudely to 1834.

MUNICIPAL LIGHT IN BOSTON.—At the meeting of the Boston Common Council last week, the proposed municipal gas and electric light order involving the purchase of plants now worth at least $50,000,000, went over, by a large vote, and on presentation of a strong report from the corporation counsel.

CABLE FOR ECUADOR.—U. S. Consul-Gen. Dietrich writes from Guayaquil that the Central and South American Telegraph Company has secured an improved contract with the government of Ecuador covering a submarine cable. The company agrees in return to complete within six months a telegraph or cable line between Guayaquil and the capital of Esmeraldas Province.

ELECTRIC FREIGHT IN THE SOUTH.—Several projects for electric freight roads are being pushed. J. M. Dewberry, of Birmingham, and associates have secured franchises in Gadsden, Tuscaloosa and Birmingham for an electric freight railway from Gadsden, through Birmingham, thence to Tuscaloosa and from there to Tidewater nearby on the Warrior River. The franchises having been secured, and something of a definite nature in the way of development is now expected.

BERLIN CITY OWNERSHIP.—A cable dispatch from Berlin of January 29 says: "At a conference of the Berlin municipal authorities to-day with the municipal officers of eight suburban towns it was resolved to take the initiatory steps to acquire the Berlin Street Railway Company, which has practically the monopoly of the street railroads of Berlin and its suburbs, and to operate roads upon the joint account of the nine municipalities. The company has a capital of $25,000,000."

RÖNTGEN-RAY WORK.—It is noted from Baltimore that during the ten years since the discovery of the X-ray important research has been made by the medical department of Johns Hopkins University through the use of the ray as a diagnostic agent; and the results of great benefits derived from the early diagnosis and study of aneurisms, or morbid dilation of the walls of arteries, through this agent, have just been compiled and described by Dr. F. Howard Baetjer, of the university. Dr. Osler has added his opinion that an X-ray examination of the chest should be made in all cases. With the ray an absolute diagnosis, both positive and negative, can be made. Thus in the Johns Hopkins University out of 104 cases reported by Dr. Baetjer during the past four years 5 per cent of the cases of aneurism were accidentally found by means of the ray, there being no physical signs.

CHICAGO SUBWAY TRACTION.—The Chicago Central Subrailroad Company will ask the City Council this week for a fifty-year franchise for a ten-mile subway system under Chicago's downtown streets, extending from the south branch of the river to Twenty-second Street. Marcus Pollasky, a promoter and former law partner of Major Edgar B. Tolman, has evolved this plan for solving Chicago's traction question. It will take $100,000,000 and a franchise to do it. The company was organized as far back as March 11, 1894, with a capital stock of $15,000,000. It has been preserved intact. Mr. William H. Llewellyn, of 171 Broadway, New York, is treasurer of the company. August Belmont and other traction financiers are said to be interested. The subway is planned to form a connecting link between the various elevated and surface railroads, the idea being to remove all tracks and elevated lines from the streets in the downtown district. The construction is to be under approval of the Commissioner of Public Works.

ELECTRIFYING CANADIAN PACIFIC.—A special dispatch from Toronto of January 27 says: "The substitution of electricity for steam as a motive power is under consideration by the Canadian Pacific Railway, and to that end officials of the road are in consultation with experts as to the advisability and probable cost of the change. If it is decided to take the plunge a test will be begun within the next six months, the Montreal-Quebec section being first equipped. Should the experiment be successful the whole line of railway will gradually be converted into an electric road. The preliminary tests, according to present intention, will be made with Shawinigan Falls power, Niagara Falls power being afterward drawn upon for operating the lines in Ontario. The desire of the Canadian Pacific Railway to abandon steam is apparently due to the prospect now being rapidly realized of the Ontario field being covered by a network of electric lines which threaten both the passenger and freight business of the steam roads."

PROTECTING NIAGARA.—Senator L'Hommedieu has introduced bills in the assembly at Albany to repeal the charters of four Niagara companies, and advises that measures be taken to prevent the ruin of Niagara Falls by Canada. A duty is suggested on all electric power generated in Canada and transmitted to this country. At Washington on January 24, a joint resolution intended to protect the waters of Niagara Falls, "to preserve their natural beauty," and to investigate the diversion of the waters of Niagara River above the falls and all the other causes operating to diminish the flow of water over the falls was introduced by Senator Platt. The resolution authorizes the President to appoint four commissioners to meet similar commissioners from Great Britain, to investigate and report on the matter and to employ the necessary surveyors and clerks. The sum of $20,000 is authorized for expenses of the commission. The resolution was referred to the Committee on Foreign Relations.

TROY MEASURE.—A special dispatch of January 22 to the Toledo *Blade* says: "A remarkable condition has been brought to light by the Board of Public Service at Troy. Investigation has discovered that some of Troy's merchants and best citizens are indebted to the city for electric light and water service, some bills dating back to May, 1903. The aggregate is $2,080.80. Both the electric light and water works systems are owned by the city. A new board took charge January 1 and at once started a new clerk at work examining the books. In the list of delinquent water renters is an attorney who owes $186, a member of a city board who owes $40, a county official who has stood off the city on a $4 bill for two years, and a physician whose water and light have been shut off because of an unpaid bill for $17. The lighting plant is in bad condition, and is declared not safe to run 24 hours. An emergency generator is being rented at $50 a month for which the rent has paid the original cost many times over."

BRIDGE MOVING PLATFORM.—A proposal to equip the Williamsburg Bridge with a moving platform railway was laid before Bridge Commissioner Stevenson this week by Max E. Schmidt, chief engineer and general manager of the Continuous Transit Securities Company. By the plan the moving platform railway, operated by electric motors, would not only cross the bridge, but the system would be extended to subways to reach from the Brooklyn Plaza to the Bushwick Avenue station of the Long Island Railroad, and, on the Manhattan side, across town to the Desbrosses Street Ferry. This would do away with the present bridge terminals. But for the fact that it would necessitate the closing of the Brooklyn Bridge, which cannot now be done, the proposal would have been made for that structure. It may be put forward when the Williamsburg and Manhattan Bridges are both in operation and one of the tunnel routes is completed. On the bridge proper the plan is to operate three distinct movable platforms. These will run constantly, and passengers can step aboard without inconvenience. The platforms will handle a crowd as fast as it collects, for each passenger is whisked away as soon as he steps on it. The platforms run side by side, the first at three miles an hour, the next at six, and the third at nine miles an hour. A passenger could step from the first to the second and then on to the third, and on the last there would be seats. The plans appear to have every element of feasibility and economy. The capacity of the bridge would be increased by 60,000 seated passengers per hour. If the company gets its platforms on the bridge it will then ask the Rapid Transit Commissioners for leave to extend its system. It is proposed, if the whole plan of thus connecting the borough goes through, to make traffic arrangements for one 5-cent fare with surface or subway lines in Manhattan and Brooklyn. The fare for carrying passengers across the bridge proper is to be fixed at two tickets for 5 cents, or 3 cents for a single fare.

Electric Power Plant of Vermont Marble Co.

By N. L. REA.

THE new power plant of the Vermont Marble Company, at Proctor, Vt., presents a number of interesting features and many industries in the country could profit from the general scheme. The power house is situated on Otter Creek, at the foot of Sutherland Falls, within a few hundred feet of the main mill of the Marble Company. This building is of reinforced concrete and masonry construction, and is connected with the forebay by a steel penstock 8 ft. in diameter and 500 ft. long. At the present there are in operation three 1,200-hp vertical shaft turbines, designed by Mr. Wm. M. White, of the I. P. Morriss Co. There are also arrangements for installing a fourth unit when needed.

These wheels operate under a head of 120 ft. and at 514 r.p.m. They are located on a reinforced concrete arch directly over the tail race, and discharge through a vertical draft tube. The water inlet is at the side of the wheel casing. The moving parts are supported by a water thrust supplied from the wheel casing, supplemented for safety by an oil-thrust bearing, supplied by a small triplex pump, driven by a chain drive from the governor shaft. This shaft is connected by bevel gears to the wheel shaft.

The wheels are direct-connected to 750-kw, 430-volt, 60-cycle, revolving-field, three-phase generators. These generators will carry a continuous load of 1,000 kilovolt-amp. On top of each generator is mounted a 35-kw, 125-volt, compound-wound exciter. One exciter is able to supply the field current for four generators. The generators connect through triple-pole knife switches to a common bus without any protective device whatever.

All the bearings are lubricated by gravity from a large tank under the roof, the waste oil being filtered and returned by a small motor-driven centrifugal pump to the storage tank. In the station are three 500-kw, 430-11,000-volt, oil-filled, water-cooled transformers; two 25-kw, 480-230-volt lighting transformers; one 35-light arc regulator, and a 100-kw motor-generator set. This set consists of a 100-kw, 250-volt, direct-current generator, direct-connected to a 150-hp induction motor. The direct current is used for crane service and electric-driven channelers in the quarries.

The motor equipment in the Proctor mills consists of the following 440-volt induction motors: Three 250-hp, three 50-hp, three 30-hp and six 20-hp. The small motors, which are of the squirrel-cage type, are belted to line shafting, starting with compensators. From the shafting are driven rubbing beds, marble polishers, a machine and carpenter shop, grist mill, stone crusher, etc. The 250-hp motors are each placed in the center of a section of the line shaft in the main mill, and are used for driving marble saws. They are a combination of the internal and external starting resistance types, being provided with internal resistance operated by a lever on the motor frame, and also with collector rings on the shaft. Ordinarily the motor will be started with the external resistance by means of a controller, the internal resistance being used only in case of emergency.

FIG. 2.—VIEW OF EXTERIOR OF POWER HOUSE.

From the main station a 11,000-volt feeder runs to West Rutland, a distance of about five miles, with a short branch line to the Albertson mill and quarries.

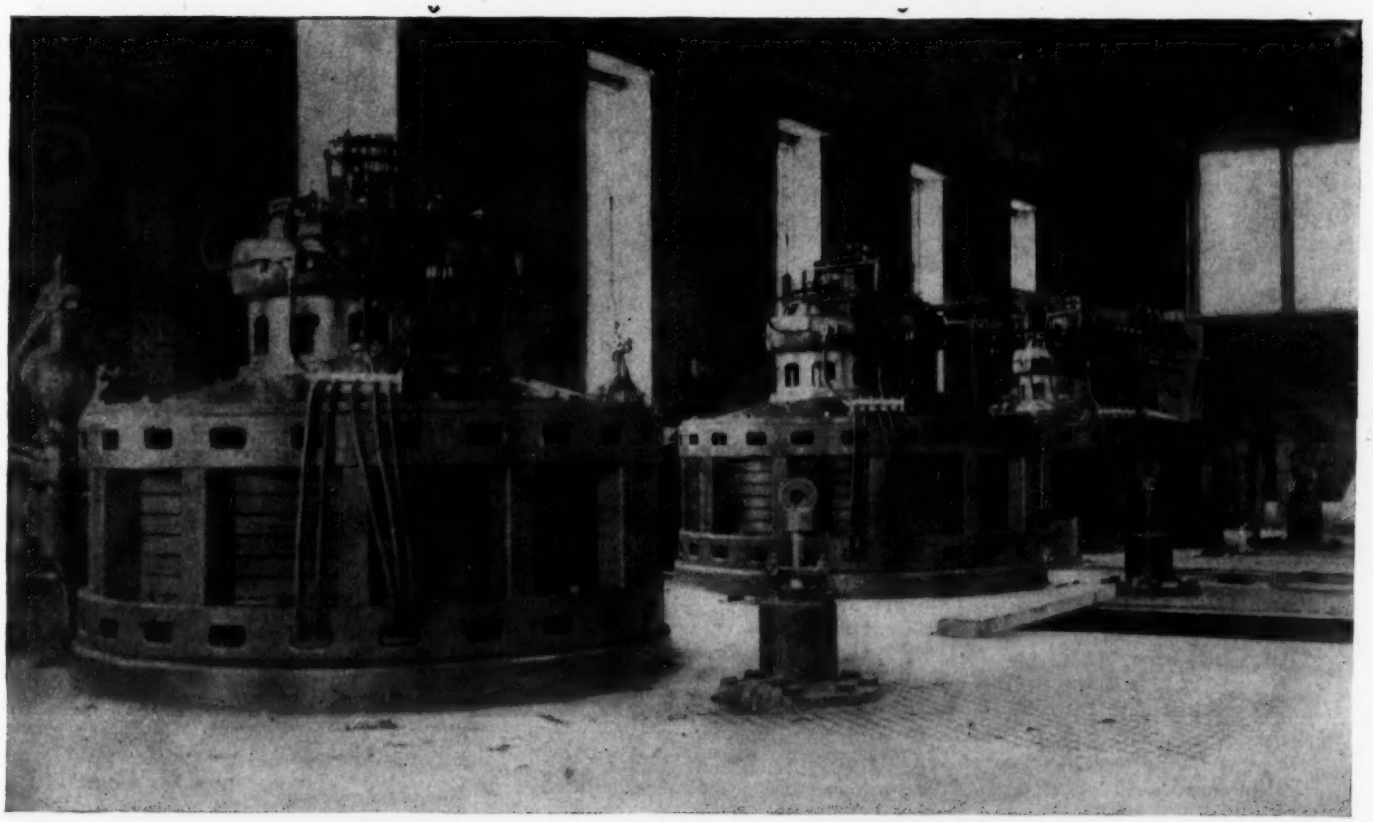


FIG. 1.—VIEW OF INTERIOR OF POWER PLANT OF VERMONT MARBLE CO.

At Albertson are located a 75-hp, 440-volt induction motor with its step-down transformers, and a 25-light arc regulator, for arc lamps in the underground quarries. In the West Rutland substation are two 50-light arc regulators, three 150-kw, 10,000-3,300-volt and three 10,000-460-volt oil-filled, water-cooled transformers,

and one 250-kw motor-generator set. This set consists of a 250-kw, 250-volt, direct-current generator, driven by a 360-hp, 440-volt induction motor of the squirrel-cage type. The direct current is used for crane service and electric-driven channelers.

The motor equipment consists of one 75-hp, one 50-hp, one 15-hp and one 10-hp squirrel-cage type, 440-volt induction motors. In addition to the above there are three old revolving armature, 3,300-volt, synchronous motors, one 150-kw, one 100-kw and one 75-kw. These latter were driven formerly by a 500-kw, 3,320-volt revolving armature generator, direct-connected to a water wheel at Proctor.

All of the electrical apparatus was supplied by the General Electric Company.

January Meeting of the American Institute of Electrical Engineers.

At the meeting of the American Institute of Electrical Engineers held in New York on January 26, 1906, there were presented two papers dealing with prime movers and alternators.

Mr. T. C. Martin, as chairman of the Institute Land & Building Fund Committee made a report up to date showing that toward the amount necessary from the Institute as its share of the cost of the land on which the United Engineering Building stands, viz., $200,000, the committee had pledges for a little over $100,000 already and had actually collected $55,000. Of the remaining $100,000 a large part would, he hoped, come from electrical corporations, but the rest of it must come from the membership. The general interest in the noble project, among the members, was shown by the fact that 620 subscriptions had already been secured, but so far only 200 of these had come from the New York district. The committee felt that the great enterprise was peculiarly one that should make the strongest appeal to the New York members, but at present only about 25 per cent of the local membership had contributed. The sum of $5 a year for 5 years would hardly strain any member, and the committee would be glad even to get $1 a year, where more could not be given. Over 500 members had given sums of $100 or less, and just over 300 of that number had given $25 each on the five-year basis. The speaker did not believe that a single man present would want to go into the new building without having done something, no matter how little, that would show his professional pride and interest in it. Such an opportunity could hardly come again in their lifetime, and should be seized. On request of Dr. Wheeler, the speaker stated that the General Electric Company had contributed and paid $25,000 toward the fund. In the seats of the hall were subscription blanks, which several members filled up before the meeting closed.

The papers were given the titles "Power Plant Economics" and "A Self-Exciting Alternator," the author of the former being Mr. H. G. Stott, and of the latter, Mr. E. F. Alexanderson.

POWER PLANT ECONOMICS.

The paper by Mr. H. G. Stott gave a complete analysis of the losses in a power plant from the coal to the bus-bars. The accompanying table shows the results obtained from such an analysis of the losses in a year's operation of what is probably one of the most efficient plants in existence to-day.

Each item given in this table was discussed in detail, and the author showed that the present type of power plant using reciprocating engines can be improved in efficiency as follows: Reduction in stack losses, 12 per cent; reduction in boiler radiation and leakage, 5 per cent; reduction in engine losses by the use of superheat, 6 per cent. Thus the net increase of thermal efficiency of the entire plant would be 4.14 per cent, increasing the total thermal efficiency from 10.3 per cent to 14.44 per cent.

The author presented curves to show that the best economy on dry saturated steam with steam turbines is practically equal to that of the reciprocating engine, and that 200° superheat reduces the steam consumption 13.5 per cent. The shape of the specific consumption curve, however, is much flatter than that of the reciprocating engine, so that the all-day efficiency of the turbo unit would be considerably better than that of the reciprocating engine, with the other great advantage of costing approximately 33 per cent less for the combined steam motor and electric generator. The expansion is relatively more nearly adiabatic in the low-pressure stage of the turbine than in the low-pressure cylinder of the engine, so that it has been proposed that

Analysis of the Average Losses in the Conversion of One Pound of Coal Into Electricity.

	B.t.u.	%	B.t.u.	%
1. B.t.u. per pound of coal supplied	14,150	100.0		
2. Loss in ashes			340	2.4
3. Loss to stack			3,212	22.7
4. Loss in boiler radiation and leakage			1,131	8.0
5. Returned by feed-water heater	441	3.1		
6. Returned by economizer	960	6.8		
7. Loss in pipe radiation			28	0.2
8. Delivered to circulator			223	1.6
9. Delivered to feed-pump			203	1.4
10. Loss in leakage and high-pressure drips			152	1.1
11. Delivered to small auxiliaries			51	0.4
12. Heating			31	0.2
13. Loss in engine friction			111	0.8
14. Electrical losses			36	0.3
15. Engine radiation losses			28	0.2
16. Rejected to condenser			8,524	60.1
17. To house auxiliaries			29	0.2
	15,551	109.9	14,099	99.6
	14,099	99.6		
Delivered to bus-bar	1,452	10.3		

the reciprocating engine should be run high-pressure where relatively it is more efficient than the steam turbine, utilizing the turbine for the low-pressure part of the cycle. In other words, use each where it is most efficient.

In discussing the gas engine, the author stated that the record of operation of several important installations of gas engines in power plants abroad and in this country seems to indicate that only one important objection can be raised to this prime mover, and that is that its range of economical load is practically limited to between 50 per cent load and full load. The author suggested that the combination of gas engines and steam turbines in a single plant offers possibilities of improved efficiency while at the same time removing the only valid objection to the gas engine. A steam turbine unit can easily be designed to take care of 100 per cent overload for a few seconds; and as the load fluctuations in any plant will probably not average more than 25 per cent with a maximum of 50 per cent for a few seconds, it would seem that if a plant were designed to operate normally with 50 per cent of its capacity in gas engines and 50 per cent in steam turbines, any fluctuations of load likely to arise in practice could be taken care of. By utilizing the waste heat in the gas engines for the purpose of assisting to make steam for the turbines, there can be saved approximately 37 per cent of the total heat lost in the gas engine. The author concludes that an internal-combustion engine plant in combination with a steam turbine plant offers the most attractive proposition for efficiency and reliability to-day, with the possibility of producing the kilowatt-hour for less than one half its present cost.

Mr. E. W. Rice, in opening the discussion, stated that the high efficiency attained in electrical machinery could, to a large extent, be attributed to the admirable testing instruments, the ammeter, the voltmeter and the wattmeters. If the steam engineer possessed the equivalent of these instruments, the efficiency of the steam engine plant doubtless would have been greatly increased. The paper of Mr. Stott is exceptionally valuable in that it presents a complete analysis of the various losses in the steam plant. The fact that no method is known at present of eliminating the enormous losses of some 60 per cent of heat units rejected to the condenser, emphasizes the importance of working with the highest possible vacuum. In a recent installation of turbo-generators in Philadelphia where the turbine is interposed between the exhaust of the reciprocating engine and the condenser, there has been added to the capacity of the plant some 1,800 kilowatts without any additional consumption of coal and without any appreciable addition to the labor. It is possible in such a plant with an increase of 50 per cent in the original investment, to increase the capacity by 66 per cent without appreciable increase in operating expenses. This method is a most excellent one for adding to the output of existing reciproacting engine stations, but in planning a new station it would seem that the added complexity would offset the advantages gained by such a combina-

tion. It is worthy of note that 53 per cent of the available energy in a certain quantity of steam lies in what is called the vacuum range.

Prof. Charles E. Lucke, of Columbia University, pointed out that the gas engine builders themselves were largely responsible for the lack of development of their own machinery. They claimed everything on earth for the gas engine, that it required only a child to run it, that it ran on so little coal that shortly it would be making coal, and people who bought these machines were inevitably disappointed. Strong points in favor of the gas producer plant resides in the fact that its efficiency is not nearly so sensitive to changes in load as is true with the boiler plant, and that the coal consumed by banked fires in the gas producer is very much smaller than for the same capacity of steam boilers. As to the reliability of properly designed gas engines, Prof. Lucke stated that he had observed in Germany numerous blast furnaces absolutely dependent on their air blast run exclusively by gas engines, in some cases without a single spare unit; thousands of dollars were tied up in the certainty of that blast, and all went right from year to year. As a gas engine is intended normally to operate at nearly its maximum load, it is said to have no overload capacity. This difficulty can be overcome readily, since it is possible to place in and out spare units on short notice, because there is no cylinder condensation to worry any one.

Mr. C. C. Chapelle remarked that the relative economies of the reciprocating-engine and steam-turbine plants as given by Mr. Stott were checked up within a fraction of a per cent by some results obtained under practically the same conditions of cost of fuel and labor in one of the large railway stations in the East.

Mr. W. L. R. Emmet outlined the operation of low-pressure turbines in series with reciprocating engines. The engines exhaust at some pressure from the atmosphere up. The steam passes from the engine into a turbine, which is a simple device without governor or any other auxiliaries which tend to complicate or make difficulties, and then passes into the condensers. The turbine performs exactly the functions of a vast third cylinder affording another expansion in the range which the reciprocating engine is incapable of filling. The turbine adds possibly 20 per cent to the output of the engine if the engine exhausts at the low pressure of 20-in. vacuum. It has no governor, and altogether is a very simple device, costing perhaps $35 or $40 per kilowatt, which is about one-fifth of what an equivalent capacity in engine equipment would cost. If cooling towers be installed in connection with any non-condensing plant the output can be practically doubled without the employment of any more men. This fact is very significant when one considers the number of non-condensing plants now in existence.

Mr. F. E. Junge, of New York, a member of the German Society of Engineers, of Berlin, discussed the influence of local conditions on power plant economics with special consideration of the mineral and metallic regions, basing his remarks on the conditions existing in Germany. He stated that if the surplus power that becomes available by the adoption of economical prime movers can be used in the works, where its value is equal to the corresponding reduction of the coal bill, or if it can be sold to advantage abroad, where its value varies with the local conditions, the gas engine will invariably be selected as the prime mover for central stations. In places where there is no market for the available surplus power, the steam turbine would always keep its field of usefulness.

A SELF-EXCITING GENERATOR.

The paper by Mr. E. F. Alexanderson described a recently developed type of self-exciting alternator which possesses a single field winding of the ordinary type carrying a direct current fed from a multi-segmental two-part rectifying commutator.

A general diagram of the alternator, which is a three-phase machine, is shown in Fig. 1. The exciting current is produced in an auxiliary three-phase winding placed in the same slots as the main armature winding. The terminals of this auxiliary winding are connected to three sets of brushes that bear on a rectifying commutator of special type. This commutator has one active segment per pole, covering practically two-thirds of the pole-pitch, the remaining one-third of the arc being insulated. Each alternate segment is connected to one terminal of the field winding, and the remaining segments to the other. By this arrangement the whole process of commutation is carried out in the stationary circuits before the current enters the field coils. The voltage generated in the auxiliary winding is sufficient to supply current for excitation at full inductive load; and the excitation is adjusted to the proper no-load value by a three-phase rheostat inserted at the neutral point of the auxiliary winding. Automatic compounding is accomplished by means of a series transformer connected to the rheostat; the transformer sends a current through the rheostat in a direction opposite to the field current, thereby eliminating the voltage drop in the rheostat. The elimination of the voltage drop in the rheostat changes over more or less of the field current from the rheostat to the series transformer. The secondary current of the series transformer is in phase with the line current, while the field current is practically in phase with the voltage. The amount of boosting in the field circuit will therefore depend not only upon the value of the secondary current, but also upon the power-factor of the load. A function of the rheostat which is just as important as the field control, is its influence on the commuta-

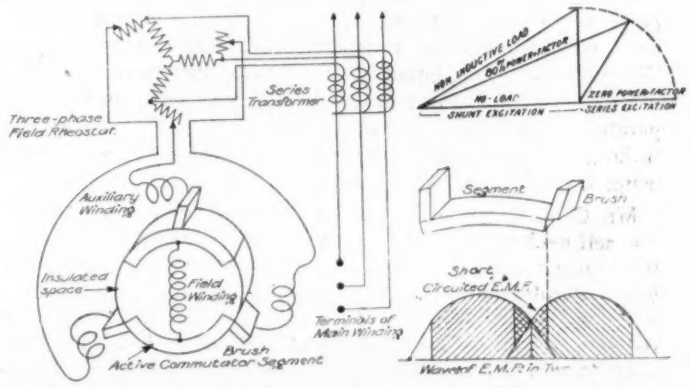


FIG. 1.—WINDING DIAGRAM, VECTOR DIAGRAM OF FIELD VOLTAGES AND DIAGRAM OF FIELD CURRENT.

tion. As far as commutation is concerned, the full resistance of the rheostat may be considered as always being in circuit, although the larger part of the field current may flow through the series transformer.

The brushes are placed in such a position that the cross current due to two brushes being simultaneously on the same segment is half as large as the field current at the moment of rupture. In this way complète commutation takes place just before the brush leaves the segment, and consequently no sparking occurs.

The method used for compounding and compensating for armature reaction both for variation of the load and for changes in the power factor is extremely interesting. The phases of the auxiliary winding are connected in such a manner that the voltage induced in them lags by 90 electrical degrees behind the corresponding phases of the main winding. The secondary circuits of the series transformer are closed through the rheostat, and the current combines with the field current at right angles at non-inductive load, but is in phase with it at zero power-factor. At full inductive load of zero power-factor the field current in the rheostat is completely neutralized by the current of the series transformer. The effect of the series transformer on the exciting circuit is, therefore, equivalent to an additional electromotive force which can be combined with the electromotive force of the auxiliary winding at an angle dependent upon the power-factor, as shown in the vector diagram of Fig. 1. The resulting electromotive force available through this arrangement, for excitation, is such as to maintain a constant voltage at the machine terminal, neglecting the ohmic drop in the armature winding. The quantities noted above are slightly modified in practice to produce the exact degree of compounding or over-compounding desired.

In connection with this type of alternator, a most convenient

method can be adopted for synchronizing. If one generator is to be started and synchronized with other self-exciting generators, it is only necessary to bring the machine up to approximate synchronous speed, and to close the main switch. The closing of the switch will cause a momentary rush of current, but the compounding of the other generators will prevent any material disturbance of the line voltage; and the machine, which has been started, will build up its field immediately. The rush of current which occurs when closing the main switch, if the generators are out of phase, is, however, not nearly so great with self-excited as with separately-excited alternators, because the self-excited machine has no definite polarity before synchronization, and the auxiliary winding tends at every moment to generate a polarity corresponding to the line voltage.

The discussion on Mr. Alexanderson's paper was opened by Prof. A. E. Kennelly, who commented on the apparent simplicity of the means which have been adopted not only for the excitation but for the compounding of the alternator described. It is considered more important to render alternators self-exciting than to compound them, because with these machines it is not the resistance drop but the impedance drop which must be overcome. The various methods which have been used in the past for compounding alternators have reached only partial success, and have not been regarded as successful with high-voltage machines. The present method, however, seems to be applicable to machines of any voltage. It looks as though a station fitted with such apparatus as this might contain no machines other than the main turbo-generators, without exciters or synchronizers, the machines being thrown on and off at will.

Mr. C. F. Scott related some experience fifteen years ago with the self-exciting and self-compounding of an alternator, when the problem was found to be an extremely difficult one. One inherent disadvantage in self-exciting methods lies in the fact that variation in speed due to load on the generator are immediately transmitted to the exciter. There have been cases where the main generator was subject to such speed variations that when the exciter was driven by the same prime mover the service was very unsatisfactory, but when the alternator received its exciting current from a generator run at constant speed, the operation was satisfactory.

Mr. W. L. R. Emmet said that he had seen the new alternator working under very trying conditions, and that the performance of it is astonishingly good. A machine of this kind has accepted sudden inductive loads of more than its rated capacity without a sign of sparking at the commutator, and without an appreciable flicker in the lamps. The rapidity of its action is very remarkable. It can be compounded so as to take care of variations in speed as well as in load. Experience indicates that there is almost no limit to the size of machine to which this scheme can be applied.

Dr. A. S. McAllister remarked that the phase position of the voltage generated in the auxiliary winding depends upon the mechanical position of the winding on the core, and the phase position of the voltage in the series transformer depends upon the power-factor of the load. At non-inductive load these two voltages add at a certain angle, and at inductive loads they add at a different angle. Since a change in the angle of the resultant voltage is equivalent to a change in the position of the brushes, he asked if this change has any effect on the commutation when the load is varied from its full inductive to its full non-inductive value without moving the brushes.

Mr. Alexanderson replied that the difficulty seems to be to make the machine commutate properly for no-load and non-inductive load, because the voltage impressed on the commutator is not of the same phase relation to the machine voltage at no-load and full load. The field is distorted by the armature reaction to approximately the same angle as the voltage impressed on the commutator is ahead of the voltage of the auxiliary winding. Therefore, the position of the brushes with no-load is nearly the best position on non-inductive load. At inductive load the voltage of the series transformer combines directly in phase with the voltage of the auxiliary winding, and at the same time the armature reaction combines directly with the field excitation, and there is no reason whatever for any displacement.

Some of the Obstacles in the Way of Electric Heating.

By C. D. Wood, Jr.

The attention of the public has lately been drawn to the progress in electric heating and cooking. This progress has been slow, but steady; however, if certain obstacles were removed from the way of the electric heating engineer, the progress would be still more rapid. In some cases electrical supply dealers are retailing six-pound electric irons in the neighborhood at $7, thereby extorting a profit of at least 100 per cent. This exorbitant price for electric irons is prohibiting the general sale of heating devices and in this way retarding the progress of electric heating in general.

Manufacturers of electric heating material have had a hard fight to obtain the proper heating units that would last. This has finally been accomplished, all things being equal, the progress from now on should be rapid.

Again, when a customer comes to the central station requesting the placing of an electric radiator in his house it is not the amount of current consumed that constitutes an objection, but when he finds that he must alter his wiring he gives up the project. If electrical contractors would take into consideration the practicability of installing electric heating and cooking devices, and for this reason increase the size of their wires, we are sure that the number of electric heaters would be very largely increased. Again, some central station companies have recommended electric radiators of one kilowatt capacity to heat a room that would require two kilowatts, and in so doing give the customer a chance to become thoroughly disgusted with the electric radiator, and eventually throwing it out of his premises.

Concerted action should be obtained between the manufacturers of heating devices, the central station and the contractors; such action would be of material benefit to all three parties.

Electric Flat Irons and Soliciting at Dubuque Iowa.

Mr. L. D. Mathes, general manager of the Union Electric Company, of Dubuque, Iowa, says that his company now has approximately 165 electric flat irons in use by its customers. The plan of introducing these irons is to place them in the hands of the customer on 30 to 60 days trial. A large stock of irons is kept on hand and if the customer does not like the weight or size of the iron furnished at first, the company will change it until the customer is satisfied. At the end of 30 or 60 days, if the customer does not return the iron it is placed on the regular bill. Only one iron so sent out has been returned. This was in a case where a servant, who did all the ironing in the house, for some reason took a prejudice against it. Although it is difficult to arrive at the exact amount of income that these irons afford, it can be determined approximately from a customer's bills before and after the irons are in use.

It is estimated that each iron on the circuit is in use about 7½ hours per week, and if the irons are the average size taking 450 watts, this means a consumption per iron of about 15 kw-hours per month. The principal hotel in Dubuque is a good electric heating customer, its power consumption for electric heating being about 3,000 kw-hours per month. Here a large electrically heated slab has displaced a gas table for broiling meats, cooking griddle cakes, toasting, etc. This slab is divided into four squares, the heat being regulated on each square independently of the others, so they can be used for different purposes.

The system of charging in Dubuque is on a two-rate system. A maximum rate of 14 cents per kw-hour is charged until the customer has used the equivalent of 2 kw-hours per 16-cp lamp connected per month. For all over that amount the rate is 6 cents per kw-hour. Heating devices are not included in figuring a customer's connected load for the reason that these usually consist of flat irons which are not on during the peak load, and to figure these in on the connected load would make the rate too high for the operation of the heating appliances.

The Lighting of Dining and Bed Rooms.

BY J. R. CRAVATH AND V. R. LANSINGH.

IN a previous article* the authors called attention to the dissatisfaction that sometimes results from the use of electricity in residence lighting due to the fact that the lamps are not properly placed or equipped for the best results. The lighting of the most used room in the house (the living room) was then taken up at length. In the present article the lighting of two other important rooms in the residence is discussed: namely, dining and bed rooms. In studying this article, the reader can with profit refer to the articles by the authors on "Reflectors, Shades and Globes" in the ELECTRICAL WORLD AND ENGINEER of November 25, December 2, 9, 16 and 23, 1905.

LIGHTING OF DINING ROOMS.

A small dining room is probably the easiest room in the house to light. All that is necessary for ordinary purposes is to throw a strong light down on the table. The reflection from the white tablecloth to the walls assists greatly in the general lighting of the room. The main thing, however, is to have the table well lighted, and the balance of the room will usually take care of itself. The simplest and most economical arrangement possible for a small dining-room is a plain one-light pendant over the center of the table equipped with some type of reflector which will throw a large proportion of its light on the table while allowing some to escape through to light the walls and ceiling.

Fig. 1 shows such a simple arrangement for dining room lighting. The light is placed six feet above the floor, which is slightly lower than the ordinary height of chandelier. The dining room shown in Fig. 1 is about 15 ft. square, and for

FIG. 1.—DINING-ROOM LIGHTING.

all ordinary occasions an 8-cp lamp in the prismatic glass reflector shown is sufficient. A lamp of larger candle power could, of course, be used on special occasions if the table were lengthened out. The particular prismatic reflector shown in Fig. 1 concentrates a little too much light on the center of the table at the expense of the edges. One giving a wider distribution of light would be desirable. This one light pendant idea can be elaborated into a very artistic fixture by substituting a chain for the rod and covering the reflector with silk or with a large art glass shade, as in Fig. 1A.

Fig. 2 shows how not to light a dining room with a one-light pendant. This pendant in Fig. 2 has the lamp placed at an angle of 45 degrees in a bell glass shade. The shade is not of the kind which greatly influences the distribution of light, and what influence it does have on the light is of no practical benefit because of the angle at which the lamp is mounted. With the arrangement shown in Fig. 2 a 16-cp lamp will not give as good results in any given room as an 8-cp with the pendant shown in Fig. 1.

Fig. 3 is another example of how not to light a dining room.

*Jan. 6, 1906, pages 29-33.

It is a case of getting a large amount of light everywhere but on the table, where it is most needed. The lamps are placed

FIG. 1A.—ART GLASS SHADE.

at such an angle that the light of the bare filament strikes directly in the eyes of those seated at the ends of the table.

FIG. 2.—EXAMPLE OF POOR LIGHTING.

Fig. 4 shows an excellent way of lighting a dining room where something a little more elaborate than Fig. 1 is desired

and where the room is too large to light well with a single pendant. In Fig. 4 the ordinary lighting of the dining room table is accomplished with the light within the opal dome reflector located in the ball of the chandelier. This opal dome gives an excellent distribution of light for this purpose and will throw light over a considerable angle so that a large table can be lighted. If additional light is wanted around the sides of the room on special occasions, the three lamps on the arm of the chandelier can be turned on. These are equipped with opal bell reflectors, which, when placed at this angle, throw considerable light to the high side walls, lighting up the plate racks and decorations of the room. Since the occupants of the dining room are usually seated around the table, frosted bulbs are not as necessary in these reflectors as they would be were the occupants of the room seated where the lights on the chandelier would come more nearly in the line of ordinary vision, but they are desirable nevertheless as they do away

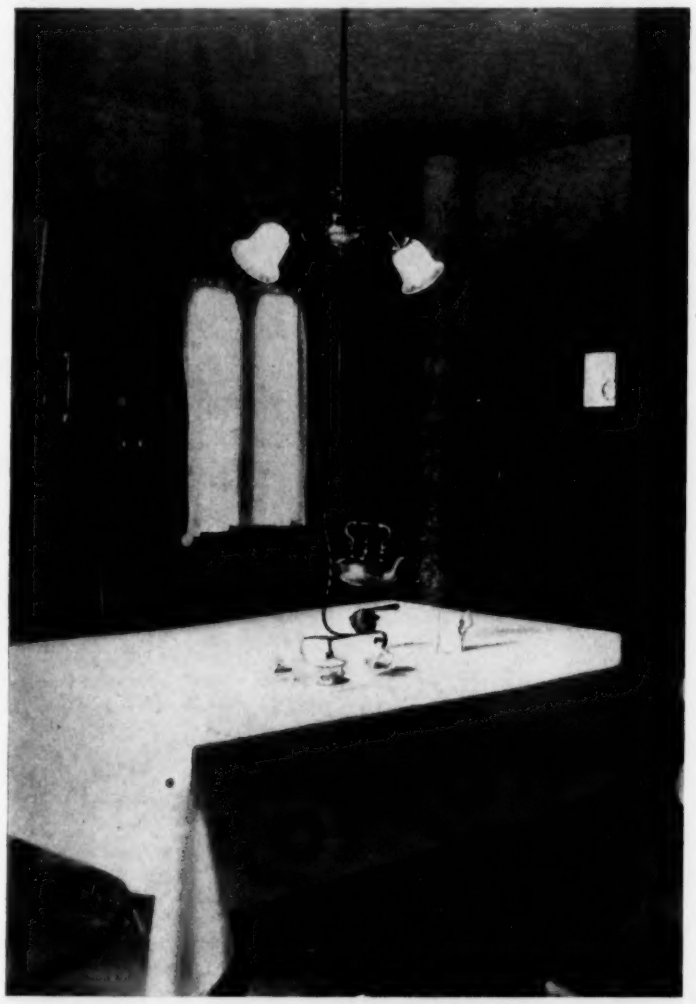


FIG. 3.—EXAMPLE OF POOR LIGHTING.

with glare and give a softer, better diffused light than the clear bulb lamps with but small loss by absorption.

Fig. 5, which is a view of one of the private dining-rooms in Hotel Stratford, Chicago, is a good example of how not to light such a room. A cluster of nine lamps is placed near the ceiling without reflectors of any kind. The ceiling acts somewhat as a reflector, but a very inefficient one. It is safe to say that the table and the lower part of the room in general would be as well lighted with half the number of lamps were some simple and ornamental form of reflector used. With a chandelier placed as high as this, the high side walls, upon which there are elaborate decorations, would receive sufficient light were any translucent reflectors used, while the table and lower part of the room would receive very much more light and the artistic effect would be in no way interfered with. In this case frosted bulb lamps are not as necessary to pleasant illumination as where they are placed lower over a table.

The examples given of dining room lighting so far have all been of rooms with but one outlet, that being in the center over the table. Side wall brackets for general lighting are

FIG. 4.—EXAMPLE OF GOOD LIGHTING.

employed in some modern dining rooms with good artistic effect. The lights on such brackets since they are sure to be in the line of vision of some one sitting at the table must be well

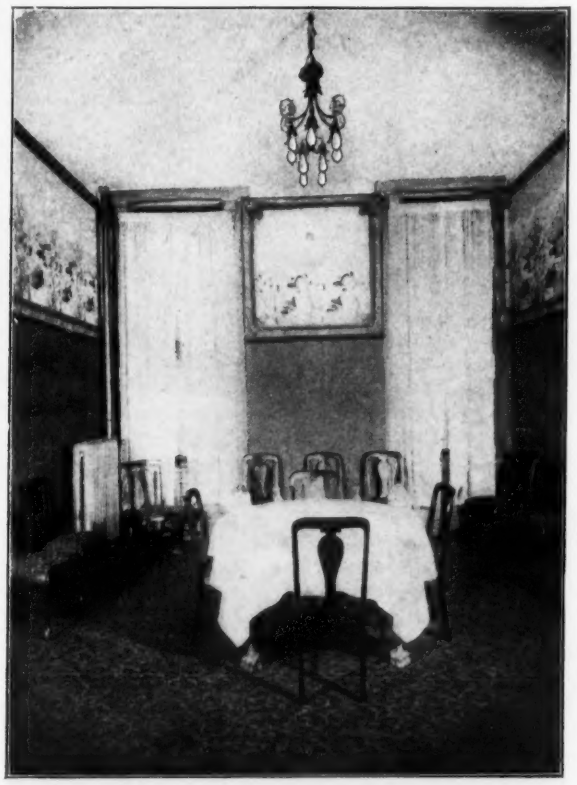


FIG. 5.—POOR LIGHTING OF HOTEL PRIVATE DINING-ROOM.

provided with diffusing globes to avoid discomfort of the persons facing them.

LIGHTING OF BEDROOMS.

The lighting of bedrooms, especially in the small residences where first cost must be kept low, is the most difficult problem to be met with in residence lighting. To light a bedroom properly, lights are needed at various times in a number of locations,

FIG. 6.—BRACKET LAMPS.

FIG. 7.—LAMPS ON DRESSER.

FIG. 8.—PORTABLE LAMP.

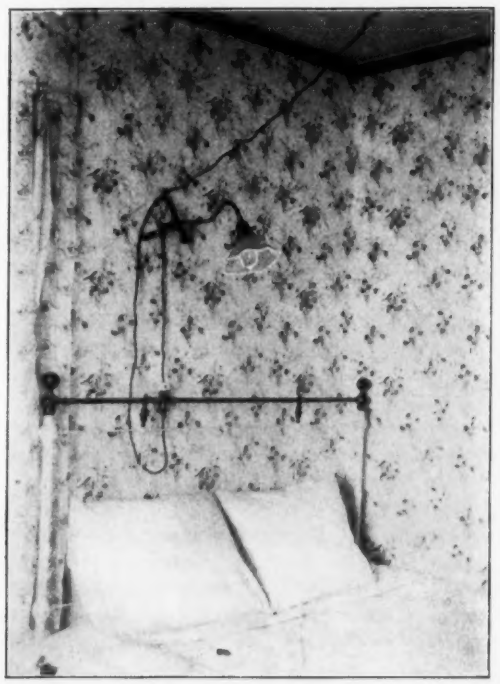


FIG. 9.—PORTABLE LAMP.

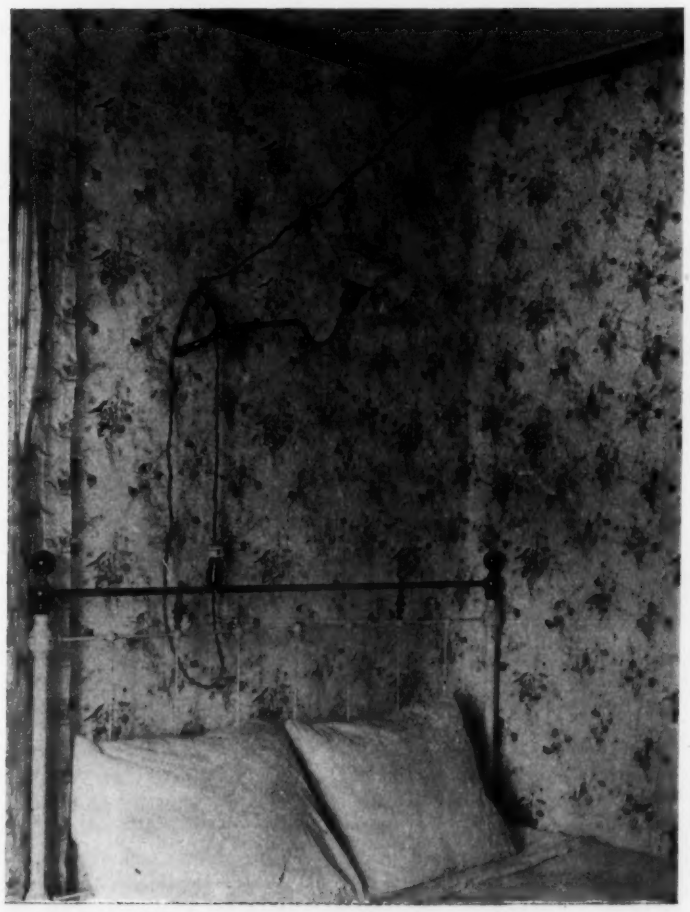


FIG. 10.—PORTABLE LAMP.

LIGHTING OF DINING-ROOMS AND BEDROOMS.

yet it is seldom that the owner is willing to pay for as many outlets as would be necessary to provide for all contingencies. Before considering specific cases, let us for a moment see just what lamps are needed in the ordinary bedroom. The first essential is usually for a lamp at the dresser so that a person standing in front of the dresser can have the use of the mirror without annoying shadows. To light a dresser mirror perfectly three lamps are necessary although they are seldom provided. One of these three lamps should be directly above the mirror, and the other two should be located on each side about 4½ to 5 ft. above the floor.

For the side brackets on each side of a dresser, upright lamps are generally preferable for the reason that if pendants are used, considerable light is thrown down on the floor, where it is practicaly of no value, little of it being reflected. If uprights are used, the light thrown upward strikes the ceiling and walls, adding to the cheerfulness and general illumination of the entire room.

The side lamps are needed to light the sides of the face of a person standing in front of the dresser and should be low enough so that there will be no shadow under the chin of a man shaving. These side lamps, if placed at this height, however, will not be high enough to light the top of a person's head so that there will be a shadow at that point, which must be obliterated by a lamp placed above the mirror for use in hair dressing if the one who plans the illumination is not to incur the everlasting ill-will of the ladies of the house. There should manifestly be some general illumination in a perfectly lighted bedroom, for which purpose a chandelier or pendant or a lamp at the ceiling in the middle of the room can be provided. In addition to this, it is desirable to provide a bracket immediately over the head of the bed for reading purposes and where it will be within easy reach of a person desiring to turn on the light in the night before getting out of bed. Besides this, if the closet is large there should be a closet light, although this is hardly necessary in small closets. We thus have five or six outlets in a perfectly lighted bedroom, which is more than in most of the other rooms in the house and would be considered out of the question by most owners of small residences. Some compromise must therefore be adopted in most cases which will cut down the number of outlets or make one or two outlets available for more purposes. The use of portable brackets as described later is one of these compromises which, although un-

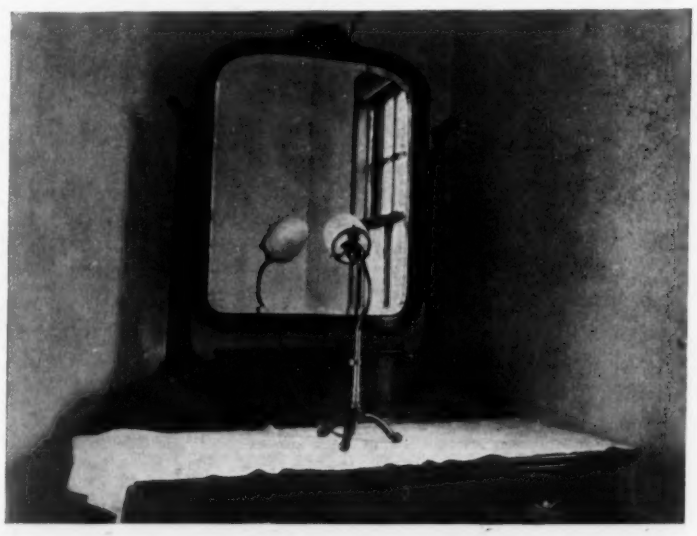


FIG. 11.—LAMP ARRANGED FOR SHAVING.

desirable from the standpoint of appearance, is nevertheless too practical and useful to be left out of consideration, especially in the wiring of old houses where one outlet in the center of a bedroom must frequently suffice for all purposes.

Another trouble usually met with in planning the lighting of a bedroom is the uncertainty as to the location of various pieces of furniture. It sometimes happens that there is only one good location for a dresser in a room, and in such a case, whoever plans the illumination can with safety and certainty place the dresser lamps with the knowledge that they will not be in the way of any future changes of furniture location the housewife may wish to make.

On the other hand it is sometimes difficult to locate brackets where they will not under some circumstances prove inconvenient and in the way of furniture. One way out of this difficulty is to

FIG. 12.—DRESSER LAMPS FOR BEDROOM.

provide one or more flush receptacles where lamps may possibly be needed. Portable brackets can then be hung up at any point and plugged into these wall receptacles, or a dresser equipped with side lamps mounted on the dresser, as shown later, can obtain current from these receptacles.

Where the general lighting of a bedroom is to be provided for by a central fixture, the problem is not materially different from the general lighting of living rooms and parlors, and for suggestions on this point the reader is referred to the previous article devoted to that subject. The points that need special consideration in bedroom lighting here are, therefore, the lighting of dressers and the provision of bracket lamps over the beds or at other desired points.

Fig. 6 is a good example of the way bracket lamps are frequently placed in a small bedroom without any regard to the needs of the occupants and at places where they are most inconvenient. In this case the architect appears to have placed the outlets symmetrically with reference to the windows without considering anything else. It is impossible to make such lighting arrangements satisfactory in a bedroom. It would have been much better to have placed these two brackets on one side of the room at such a distance apart that a dresser could have been placed between them. The lamp should be frosted if used without a globe or else should be covered by an enclosing globe of frosted, sand-blasted or Holophane glass for diffusing the light.

Fig. 7 shows an arrangement of lamps mounted directly on a dresser. On a dresser especially designed with reference to having electric lamps mounted upon it, the arrangement might be made very artistic. On the dresser shown, there are two wall sockets mounted on each end of a piece of standard hardwood molding fastened against the back of the mirror. The unsightly ends of the molding are covered with round blocks of wood such as are used in mounting wall sockets, and the sockets are mounted on these blocks, the wood being finished to correspond with the dresser. The flexible cord and attachment plug which connect to the wires in the molding make it easy to connect up these dresser lamps to any socket outlet in the room. Such an outlet can either be located along the wall or at the middle of the room. In the latter case a long lamp cord is necessary. This arrangement has the advantage of always hav-

ing the lamps on the dresser wherever it may be moved. The lamps as shown are excellent for shaving purposes, but must be supplemented by some higher lamp for hair dressing, as these lamps are too low to light the top of the head.

A diffusing and directing globe is placed on these side lamps for two reasons: In the first place, these lamps are so nearly in the ordinary line of vision that they would have a decided

FIG. 13.—BEDROOM, HOTEL ASTOR, NEW YORK.

blinding effect if they were not provided with something to diffuse and reduce the intensity of the light. As far as diffusion is concerned, the same result could be secured to a less degree by the use of frosted bulb lamps or by sand-blasted, enclosing globes. The second reason for using these globes in this place was that, in addition to diffusing the light, they direct the rays. The type of globe used, as seen from the previous articles on reflectors, shades and globes, gives such a distribution of light that when placed as are these lamps on the side of the dresser mirror, much more light will be thrown on the face of a person standing in front of the mirror than with any of the other diffusing globes mentioned.

Another portable arrangement very useful in bedrooms where a number of outlets is wanted is shown in Figs. 8, 9 and 10. This is a portable wall bracket, which can be hung on a hook at any point desired and attached by means of a flexible cord and attachment plug to a socket anywhere in the room. In Fig. 8, this portable bracket is shown directly over the mirror of a dresser. It is equipped with a prismatic glass reflector, which throws a powerful light down on to the head of a person standing in front of the dresser, hence this arrangement is excellent for hair dressing, and in fact, almost all purposes for which a dresser light is needed except shaving. It can be made to serve the purpose of a shaving light on a dresser in a manner mentioned later.

Fig. 9 shows the use of the portable wall bracket as a reading light over the head of a bed. In this case the key socket at the attachment plug is within easy reach for turning on the light in the night. With the bracket in this position and a concentrating type of prismatic glass reflector, a 4-cp lamp is sufficient for reading purposes if the bracket is to be used for that purpose alone.

If the ceiling of the room is of light color, this bracket can be used to give a fairly good, evenly diffused light over the entire room by simply turning it up as shown in Fig. 10. By means of a thumb screw the arm of the bracket can be loosened and turned around at any angle. It can also be extended several inches to adapt it to different requirements. By turning the lamp towards the ceiling as in Fig. 10, the ceiling acts as a reflector to light the whole room by diffuse reflection and the light is soft and pleasing without being intense at any one point.

Fig. 11 shows how this bracket can be made to serve for shaving by setting it on the dresser in front of the mirror so as to throw the light into the mirror. The reflected light from the mirror falls on the face.

It is suggested that where the dresser lamps shown in Fig. 7, together with a portable fixture of this kind, are used in a bedroom for furnishing most of the light and the owner does not wish to pay for more than one outlet, a good arrangement is to place a 3 or 4-light wireless cluster at the ceiling in the center of a room. Attachment plugs for various portable devices can then be inserted in this wireless cluster or a lamp on the drop cord in the center of the room can be secured by attachment in a similar manner. Of course, these are in the nature of makeshifts, but, as said before, bedroom lighting, especially in houses already wired, is very much of a compromise between what is desirable and what is feasible.

For large bedrooms where expense does not prevent, the arrangement of dresser lamps shown in Fig. 12 is desirable. This dresser has a light at each side as well as one directly over the middle of the mirror. This is the ideal arrangement as far as the location of the fixtures is concerned, although there is

FIG. 14.—BEDROOM, CLAYPOOL HOTEL, INDIANAPOLIS.

some room for criticism as to the shades used on the brackets each side of the dresser. With brackets in such positions, where open shades of any kind are used, the lamps should have frosted bulbs or be enclosed in Holophane globes or sand-blasted to diffuse the light. If a Holophane globe or shade were used on the brackets shown in Fig. 12, that type should be selected which throws a maximum light in the desired direction—on the

face of the person using the dresser in this case. As regards the lamp on the pendant directly over the dresser, it would be well to put inside the ornamental globe some small reflector which would be concealed by the globe but which would assist greatly in throwing the light down on the head of the person using the dresser. As said before, this is a case where expense is of secondary importance, otherwise a different equipment both of the center chandelier and of the pendant over the dresser might be advisable. The ornamental opal globes on the center chandelier absorb a large amount of light and do not distribute it very well in downward directions where it is most needed. They diffuse the light well, however, and so are good from every standpoint except that of low cost of operation for a given amount of light.

A way in which the provision of three outlets for the lighting of the dresser mirrors can be obviated is by placing one bracket lamp directly over the mirror, as in Fig. 12, and if the room is to be used by gentlemen who wish to shave, providing a portable, electrically-lighted shaving mirror with frosted bulb lamps mounted on each side of it. Such mirrors can be purchased ready made in the open market or made to order to suit the purchaser. They are provided with attachment plug and cord for attachment to any socket and can be hung anywhere in a bedroom.

Where but a single bracket lamp is provided over the dresser

FIG. 15.—BEDROOM, BROWN PALACE HOTEL, DENVER.

mirror, it may be located too high to be reached with comfort. In fact, in a new house it should be located high to provide for the possibility of dressers with high mirrors being placed under it. For this reason a chain pull socket should be used on the bracket unless it is to be controlled by a wall switch.

Fig. 13 shows one of the bedrooms in Hotel Astor, New York. Here the dresser is lighted by two vertical 16-cp lamps placed on a bracket above the mirror. These lamps are equipped with Pagoda prismatic reflectors of a concentrating type and throw a very powerful light down on the person standing in front of the dresser and some light is reflected from the cloth on the dresser to the chin so that shaving is possible, though not altogether easy because of the shadow under the chin which is relatively much darker than the face. This scheme is hardly practicable where less than two 16-cp lamps are used, as that amount is needed to secure sufficient reflected light from the white cloth on the dresser to light under the chin. With lamps on each side of a mirror, lamps as low as 4-cp can be used with excellent results. In Fig. 13 the general lighting of the bedroom is beautifully accomplished by three 16-cp lamps at the ceiling, with Pagoda reflectors. These lamps have frosted bulbs and the room is well illuminated to its farthest corners so that reading can be done in any place in the room, although the light is much the strongest under the chandelier. The number and candlepower of lamps in this bedroom is larger than would usually be demanded in a private house, since in a hotel of this class, it is necessary to provide ample light to suit the most exacting rather than to attempt economy. The chandelier arrangement, shown in Fig. 13, for general lighting, would not be satisfactory without good reflectors on the lamps, and in fact, was not satisfactory before efficient reflectors were used for throwing the light down where it was needed.

Fig. 14 shows a peculiar lighting arrangement in one of the bedrooms at the Claypool Hotel, Indianapolis. The arrangement is remarkably unsatisfactory and inefficient. At the far end of the room is a two-light fixture suspended from a wall outlet. This in itself, is bad for mechanical reasons, and the fixture is of very little use where it is located, as it is almost over a radiator, so that it cannot be used to advantage either for the dresser or for reading. The two lamps used on this fixture might have been placed to much better advantage on each side of the space now occupied by the picture, in which case the dresser should occupy that location. The three-light chandelier in the middle of the room, in order to give the best general illumination in the room, should be higher and equipped with reflectors. The chandeliers in this room have roughed white shades, which are excellent for diffusing the light, but they do not cover the filaments and they let entirely too much light escape upwards. The room is not well lighted in all parts, even though the number of lamps is sufficient to more than accomplish this. It will be instructive to compare this room with that shown in Fig. 13, as the same amount of current is used in both cases and the room shown in Fig. 13 is much the better lighted.

Fig. 15 shows one of the bed rooms in the Brown Palace Hotel, Denver. Although it is not perhaps apparent from the photograph, the room is very long and narrow. The chandelier is equipped with corrugated, glass, bell shades, which act to some extent as prismatic reflectors, although very inefficient ones. The notable mistake made in this case is that the lamps are pointed cross ways of a long, narrow room, so that the maximum light is thrown on the side walls opposite the chandelier, leaving the ends of the room in comparative darkness. This is a common mistake, as there seems to be some kind of a tradition among architects and electric light wire men that a two-light chandelier should be pointed crosswise instead of lengthwise of a room or hall. If the lamps were bare and not equipped with reflectors, this would be the best arrangement, but when reflectors are used, lamps should be pointed lengthways of a room of hall. In this bedroom no provision is made for dresser lighting, so that the dresser must be moved into the middle of the room if the user thereof is not to stand in his own shadow.

The Springfield, Ill., Light, Heat and Power Co.'s Station and System.

THE Springfield Light, Heat & Power Company, of Springfield, Illinois, has recently built a new power station, for lighting, steam and hot water heating and railway purposes. This power station is notable on account of the size of the exhaust steam heating system supplied from it. In the majority of cities where exhaust steam or hot water heating is being done, the power stations are of much smaller capacity. The heating system of the company at Springfield, is one of the largest operated by any electric central station company in the country. About 200,000 sq. ft. of hot water radiators and 150,000 sq, ft. of steam radiators are connected to this station. On account of the exhaust steam heating load, the station is, of course, equipped with simple non-condensing engines.

The station is also interesting to electrical engineers because of the fact that during a part of the day, motor-generators supplying the alternating-current lighting and power system are operated off the railway bus-bars. This is done with a voltage regulation which is entirely satisfactory, as will be seen later. The station is located about five blocks from the center of the business district and is alongside a railroad. The coal is obtained from mines near the city. The coal now used is screenings which cost about 70 cents per ton.

Fig. 1 is a drawing showing a typical cross section through the power station giving the general arrangement of apparatus. The engine and boiler rooms are each 54 ft. wide and 150 ft. long. One of the notable things about the design is the large

amount of room behind the boilers between the boilers and engine room walls. This space was allowed by the designers to provide for the exhaust steam and hot water heating apparatus, and this apparatus occupies a large portion of the space; although it is not shown in the cross sectional drawing, Fig. 1. Part of the basement under the boiler room is utilized for fuel economizers, which in this case are used to heat water for the heating system, as explained later.

A view of the engine room is shown in Fig. 2. This photograph was taken from the 20-ton traveling crane made by Pawling & Harnischfeger, of Milwaukee. The engine room necessarily contains several kinds of generating machinery, because of the various kinds of service given, some of which classes of service are relics of the old days.

Beginning with the light and power apparatus, there is one 800-kw, 2,300-volt, 60-cycle, three-phase generator direct-connected to a Fulton Corliss engine. There is also one 300-kw generator of the same voltage and frequency. There are two 100-kw, 250-volt, direct-current generators for power service direct-connected to Ideal engines.

In the railway department, there are two 550-volt direct-current generators, one of 800-kw driven by a Fulton Corliss engine, and one of 400-kw driven by a Bates Corliss engine.

There are several motor-generator sets. The largest of these

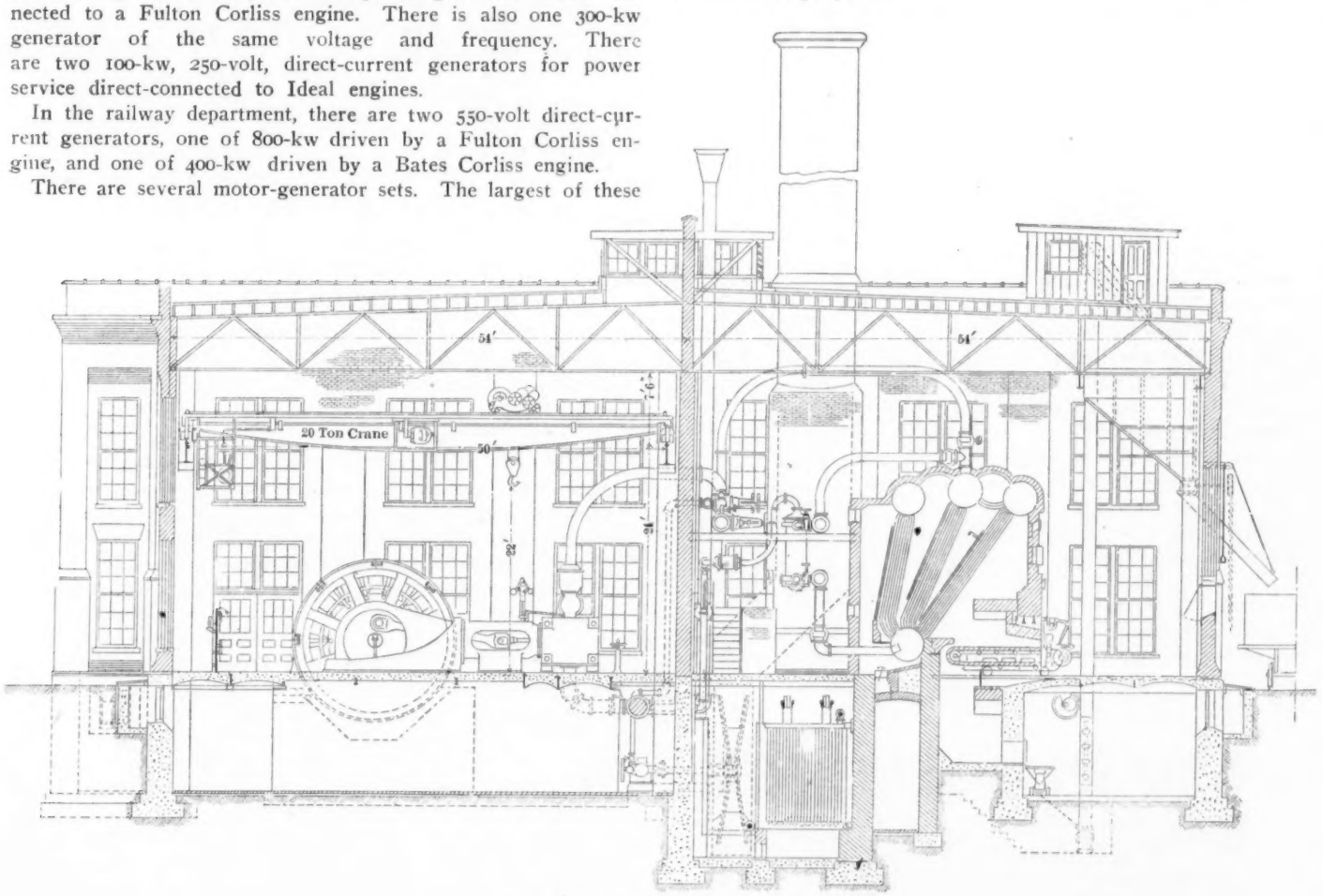


FIG. 1.—SECTION OF POWER STATION, SPRINGFIELD.

is of 425 kw. On one end of its shaft is a 2,300-volt, three-phase, 60-cycle, alternating-current motor or generator, and on the other end a 550-volt, direct-current motor or generator. This set is used for either supplying the alternating-current power and light load from the railway bus-bars, or for supplying the railway load from the alternating-current bus-bars. Another motor-generator consists of an 100-hp, three-phase, induction motor, connected to a 75-kw, 250-volt, direct-current generator used for supplying the 250-volt power load. It is the usual practice at the present time to operate one of the large railway generators during the day to supply both the power and lighting load, the lighting load being carried by the large motor-generator.

The boiler-room contains 8 water tube boilers, six of which are Stirling of 414 hp, and two Babcock & Wilcox, each of 264 hp. All these boilers were built for 150 lbs. steam pressure. The stacks are of steel 60 ft. high above the grates and induced draught apparatus is used, for which purpose there are two 14 x 14-in. Buffalo Forge engines driving 18-ft. diam. x 5-ft. fans. The boilers are equipped with Green traveling link grates. Coal is shoveled from cars on the side track as indicated, just outside the boiler room in the space in front of the boilers and from there is shoveled into the hoppers of the mechanical stokers. Overhead storage bins are to be added later. Ash-conveying machinery was provided in the basement, but on account of troubles from breakages of the conveyors this conveying system is being abandoned in favor of dump cars which will be hoisted by an elevator of the hydraulic plunger type, located at one end of the boiler room.

Green fuel economizers with 11,500 sq. ft. of heating surface in three sections are located in the basement in a by-pass flue. These are used for heating water for the hot water heating system. A diagram of the piping connections is given later. There are six Yaryan-Stahl condensers each having 500 sq. ft. heating surface, for heating water from the exhaust steam. There are two Schott condensers each of 3,000 sq. ft. heating surface for the same purpose.

Three hot water circulating pumps for the hot water system have been installed, one of which is 15x16½x18 in., and the other two are 14x12x18 in. All are of the Laidlaw-Dunn-Gordon make.

For feed water pumping, one Worthington admiralty type pump 12x9¼x10 in. has been provided; two other pumps being available as feed pumps in case of emergency. Another feed pump is being purchased, however; the dimensions of which are 14x10x15 in., of Dean manufacture. Two horizontal 9x5¼x10 in. Worthington pumps are provided for feed water and other uses. Two open feed water heaters each of 1,000 hp are in use; one of Cookson and one of Cochrane make.

The station is piped for compressed air, which is used for cleaning armatures, and also supplying the automatic temperature regulators, which are used in all building where hot water service is supplied. A Westinghouse locomotive air pump maintains the air pressure. In the basement is a laundry for cleaning waste.

The station is kept very neat and clean; one thing which adds to the neatness of the concrete engine room floors being that a good floor paint for cement floors is used, which seems

to act as a filler for the natural roughness of the cement, and prevents the oil from getting into the cement floors so that it cannot be removed. After the floor was so painted, it was very easy to keep it clean. The paint used is the Diamond brand floor paint furnished by the Billings, Chapin Company.

STATION PIPING FOR HEATING SYSTEM.

As said before, the apparatus for hot water and exhaust steam heating occupies considerable space in the power house, and is of much more importance than usual in a power house doing this kind of work. It will be noticed from the enumeration of the power house apparatus, that there are two sets of condensers for use in heating water for the heating system which are supplemented by a bank of fuel economizers for utilizing the heat in the fuel gases. Even these three means of heating are not sufficient in the coldest weather, and two of the boilers in the station have been fitted up so that they can be completely filled with water and used as hot water heaters. The present arrangement of piping for hot water heating in this station is of interest because it represents the result of the company's experiments and experience along this line.

Fig. 3 is a diagram showing the general scheme of the hot water circulating system inside the station. The return water as it enters from the street (Fig. 3), first goes through the circulating pumps from which a 12-in main takes it to a header to which are connected the six Stahl condensers in multiple. In multiple with these condensers there are also three fuel economizers. After leaving the economizers and first bank of condensers the water passes to the two 3,000-ft. Schott condensers. These latter condensers are also connected in multiple. After leaving the Schott condensers, all the water must pass through the water-tube boilers, which are connected in series, unless the by-pass on the boilers is open, in which case, of course, the boilers would be out of use. After leaving the boilers the water flows to the outgoing street main.

The important thing to notice in this piping arrangement, is that the boilers are connected in series with the rest of the heating apparatus. Attempts to operate the boilers in multiple with the other heating apparatus have not resulted satisfactorily.

So far only the connections of the hot water circulating system have been considered. The connections of the condensers to the exhaust steam main which runs the length of the engine room are very simple. These condensers are simply "dead-ended" onto the exhaust main. That is, one end is connected to the exhaust main and the other is closed. The condenser, therefore, takes exhaust steam as fast it can be condensed by water circulating in the condenser. Precautions are taken to let out whatever air that may accumulate in the condenser, just as in a one-pipe steam radiator. The exhaust steam main in the engine room basement is divided by valves into two parts.

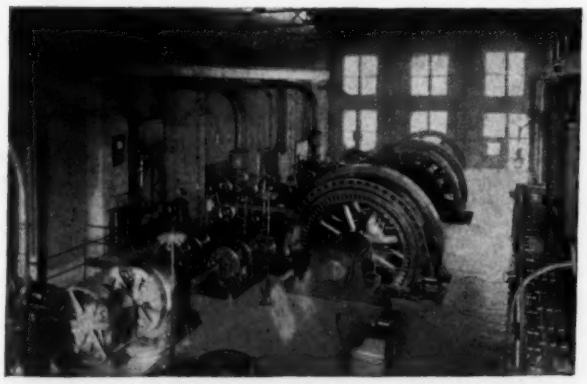


FIG. 2.—VIEW OF ENGINE ROOM.

STATION PERFORMANCE.

The station was designed with simple non-condensing Corliss engines, for the obvious reasons that the exhaust steam was needed for heating purposes. There is also a further reason that coal is so exceedingly cheap. The economical performance at this station as regards coal consumption is very interesting, because of the light it throws on the question which always comes up in station design where coal is very cheap, viz.: is the saving by compounding and condensing sufficient to pay interest and maintenance on the cost of the compounding and condensing? The coal consumption of this station, during those portions of the year when exhaust steam is not used for heating is about 10 lb. per kw-hour.

The maximum load on the station is now about 2,300 kw,

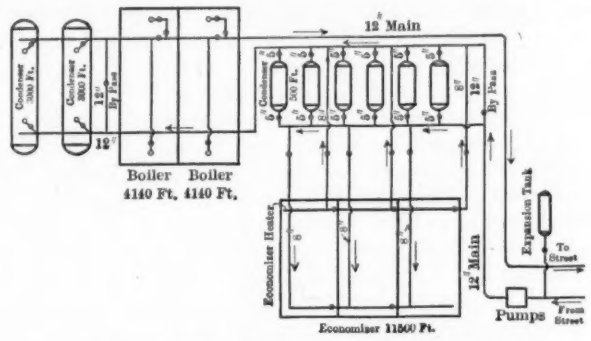


FIG. 3.—ARRANGEMENT OF HOT WATER CONNECTIONS.

of which 1,600 kw is in alternating-current output. Kilowatt-hour meter readings are taken daily. The average daily output for December was 19,153 kw-hours; the maximum being 24,207, and the minimum 14,414. The output in commercial light and power being for the month 385,338 kw-hour, while the railway output was 208,413 kw. This does not include some series arc lighting still done from another old station belonging to the company. The increase in light and power output over last year is approximately 20 per cent.

Fig. 4 is a reproduction of the Bristol recording voltmeter chart, showing the voltage at the station alternating-current bus-bars for 24 hours November 19, 1905. As this was taken from the station bus-bars it includes compensation for the linedrop made at the station; the voltage being raised during the heavy load in the evening. A noticeable thing about this voltmeter chart is the regulation shown between the hours of 9 a. m. and 5 p. m., during which time the alternating-current load was supplied from the large motor-generator, the motor of which obtains direct-current from the railway bus-bars. As the railway generators are compounded to raise the bus-bar voltage, with increase of load, the railway bus-bar voltage is constantly changing, which of course, results in the changes of speed of the motor-generator. To maintain constant voltage on the generator of this motor-generator set under such conditions, a Tirrell voltage regulator is used. A few years ago, before voltage regulators were perfected a voltage chart showing such regulation under these conditions was unknown.

A remarkable record has been made by the commutator on the 400-kw railway generator in this plant. This generator, which was formerly in use in another station and frequently overloaded, has now been running about five years, and the commutator is apparently in as good condition as it was after the machine had been running a few days. No special care has been given to this commutator beyond an ordinary wiping off and a very small amount of lubrication. The brushes furnished with the generator are still in use on it.

DISTRIBUTION SYSTEM.

The company maintains three classes of circuits as follows: 2,300-volt, 60-cycle, three-phase, for power and single-phase for light; 550-volt direct-current for power supplied from the railway bus-bars; 250-volt direct-current for power.

The 550-volt motors on grounded circuit are used in places where the company could not supply them from other circuits at the time they were installed, and it was a case of the customer using a 500-volt grounded circuit motor or a gasoline engine, the insurance people seeming to prefer a well installed motor of this kind, to a gasoline engine.

The company has about 1,100-kw capacity in transformers in

the down-town district, and 1,200 kw in outlying districts of which latter 250 kw is in the shape of transformers supplying power to small factories. The lighting distribution is all single-phase, three-phase being used for power.

UNOBTRUSIVE LINE WORK.

The line work in the down-town district, is notable on account of the care which has been used to make it as neat and unobtrusive as possible, and so keep down any objections to its appearance, which might result in a movement to have wires

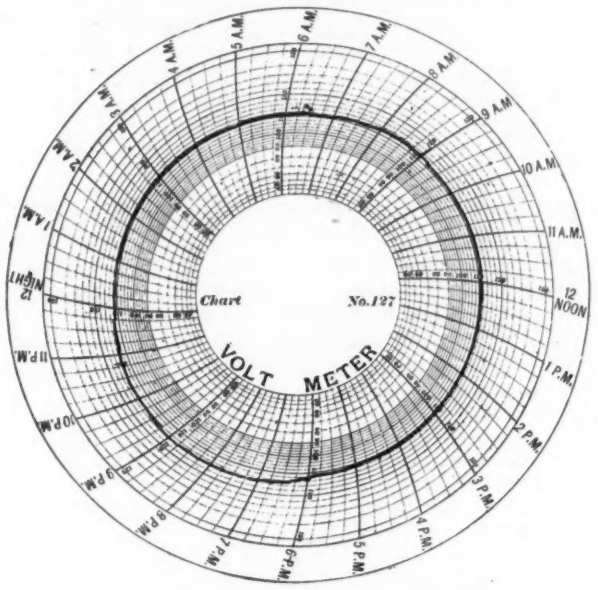


FIG. 4.—CHART OF VOLTAGE REGULATION.

placed underground in the down-town district. For this reason secondary circuits in the down-town districts are two-wire instead of three-wire. The secondary mains are kept off of the poles as far as possible, and are run along the buildings on brackets with head guys to the building at each end. Customers' service taps can then be made directly to the main on the building, and the only secondary wiring which appears overhead in the alleys except on the building, is that run from the pole on which the transformer is located to the mains on either side of the alley. This plan not only does away with the heavy secondary mains on the poles, but with the numerous customers' service wires leading out from these mains, all of which lead to confusion of the overhead work.

In the residence district, three-wire secondary distribution is used, because of the distances to be covered are greater and the added complication of the third wire is not so important as down town.

The maximum size of transformer placed on a pole is 37.5 kw. Transformers as large as 50-kw are located in areaways. The secondary mains in each block are independent of those in other blocks, this being also a part of the general plan to keep down the amount of secondary wiring overhead. The primary circuits of transformers and branch primary circuits are provided with D. & W. enclosed fuses and cut-out boxes.

The hot water heating system is carried as far as one mile from the station. The exhaust steam heating, of course, does not cover so great a distance. The Powers automatic temperature regulators are used on all hot water services to prevent waste of heat. The company find it economical to do this rather than to depend on customers to shut off radiators when the room gets above a certain temperature; the customers' regular method is to open the windows wider.

CONNECTED LOAD.

The company has the equivalent of 40,000 16-cp incandescent lamps connected, to which should be added 1,000 alternating-current multiple arc-lamps, some of six and some of four amperes capacity, and 75 Nernst glowers. The Nernst lamps where installed have proved fairly satisfactory. The company find their cost of maintenance to be about the same as that of alternating-current arc-lamps. The company owns and maintains all lamps of whatever description and furnishes free renewals on incandescent lamps, including those of "Meridian" type.

The connected motor horsepower amounts to about 1,200. On account of the capacity of the new station and the economy with which power can be produced, as well as the importance of supplying the heating load with exhaust, rather than with live steam, the company has been actively engaged in following up the business of securing both large and small power users.

Springfield is a very good city in which to secure this class of business, and this load is growing rapidly. One of the most noticeable large power contracts secured recently, is that of supplying the Springfield Boiler & Manufacturing Company, with all the power for its new factory. This contract involves 300 hp in 440-volt, induction motors. Of course a low rate had to be made to secure a contract of this kind, as a factory of this size is strongly inclined to put in an isolated plant. This contract was made with a guaranteed minimum bill per horsepower connected and a very low rate for power consumed per kw-hour. The plant is located three-quarters of a mile from the power station, and is supplied over a separate line and metered at the power station.

RATES.

The rates are based on a maximum of 13 cents per kw-hour with 10 per cent discount for prompt payment. The minimum bill for each customer is $1, but beyond this no charge is made for the connected load that a customer may have. Long-hour consumers whose power consumption is as high as 350 kw-hours per month get a rate as low as 6 cents. The rates to ordinary long-hour power consumers get down as low as 4 cents per kw-hour, the discount being based on the amount of power consumed. By this arrangement elevator motors which take but a small amount of energy per month in proportion to their maximum demand bring a high rate, as it is considered they should.

Steam Department.—Direct radiation, 25c. per sq. ft. per annum; indirect radiation, 30c. per sq. ft. per annum; economizing coil, 15c. per sq. ft. per annum; meter rate, 50c. per thousand pounds water, with discounts for quantity.

Hot Water Department.—Per sq. ft. radiation, 15c. The payments are made in eight installments as follows: October 1, 5 per cent.; November 1, 10 per cent.; December 1, 15 per cent.; January 1, 20 per cent.; February 1, 20 per cent.; March 1, 15 per cent.; April 1, 10 per cent.; May 1, 5 per cent.

METER TESTING.

The practice of the company is to bring in residence customers' meters for test every six months, and commercial every

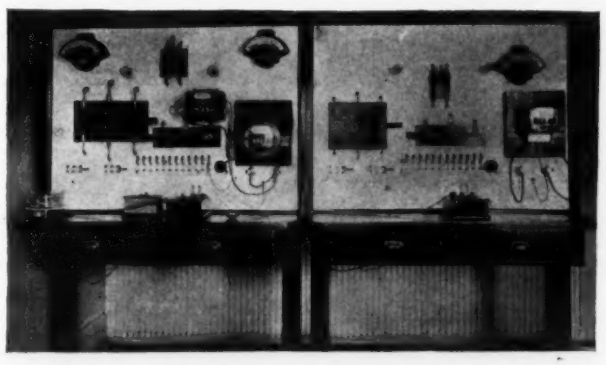


FIG. 5.—METER TESTING BOARD.

four months. The company has connected about 2,800 meters and five men are employed on the work of installing, bringing in and testing meters. The meter-testing board is shown in Fig. 5. Both wattmeters and watt-hour meters are used in testing. An alternating-current induction meter is being tested on the left-hand panel. The meter under test is seen at the right bearing the number 2818. This meter happens to be of the Westinghouse type with glass case. In series with it is a Stanley watt-hour meter seen just at the left of the

meter under test. On this Stanley watt-hour meter, one division of the first dial equals 3,000 watt-seconds, so that it gives fairly accurate readings on short runs. It is used for testing meters up to 15 amperes capacity. A Wiston indicating wattmeter is provided, which is seen on the table in front of the board. This indicating wattmeter is available for testing up to 25 amperes without a series transformer, and from 25 to 300 amperes with a series transformer. Back of the board is a choke coil for giving the meters an inductive load. Load is obtained by lamp banks behind the board, these lamp banks being controlled by the rows of single-pole switches seen on the front of the test panels. Meters to operate on inductive loads are tested with power factors as low as 75 per cent.

PROFITS OF THE HEATING BUSINESS.

In answer to the often asked question whether heating from a central station is more profitable than condensing the exhaust steam with the economy resulting from the use of condensers, General Manager Emil G. Schmidt thinks there is no question but that a compound condensing plant would save enough coal during a year as compared to a simple non-condensing plant to more than counterbalance any profits arising from the heating business. On an investment of about $200,000 in the hot water heating system, the company gets a gross revenue of only $30,000 per year out of which to pay interest, depreciation and operating expenses of this part of the business. This in itself can hardly be called an attractive investment. Nevertheless, there are some reasons of policy why it may be well for a central station to conduct a heating business because of the tendency it has to keep down the number of isolated plants in a town and to prevent competition in the lighting business from plants established primarily for heating.

The electric lighting, railway and gas business of Springfield is all controlled by a syndicate operating similar properties in other cities.

The officers of the Springfield Light, Heat & Power Company are H. D. Walbridge, president, New York; Emil G. Schmidt, general manager, Springfield; W. H. Brown, secretary, and H. T. Willett, auditor. The operation of the light, heat and power company is under the supervision of A. V. Schroeder, general superintendent, who has under him as department heads W. B. Reid, chief engineer; L. G. Eberly, chief electrician; R. L. Flannigan, superintendent of line construction; H. E. Powell, superintendent of heating, and A. D. Mackie, superintendent, new business department. The power station which has been described was built under the supervision of Mr. Schroeder, according to plans and specifications drawn up by Lichter and Jens, consulting engineers of St. Louis.

Central Station Economics in Massachusetts.

The Malden Electric Company was formed in 1885 and was an outgrowth of the Malden Electric Light Company, formed in 1880. It is under the same centralized management as the Haverhill Electric Company, Messrs. Tenney, Royce and Bradley, of 84 State Street, Boston, being the principal officials. The local manager is Mr. A. E. Bliss, with Mr. F. C. Sargent, chief electrician. The company is one of the most prominent organizations in Greater Boston and serves the four suburban residential cities of Malden, Melrose, Everett and Medford, covering 25 square miles of territory.

The power station is located in Centre Street Court, Malden, and is a remodeled plant built for efficient operation. The original station contained an antiquated outfit of belted units driven by non-condensing engines, poor coal-handling facilities and obsolete machinery in general. Production economy was out of the question in the modern sense. The new plant contains one 650-hp and three 400-hp Aultman & Taylor water-tube boilers, operating at 150 lb. steam pressure. The 650-hp boiler has 6,500 sq. ft. of heating surface and 105 ft. of grate surface. The 400-hp boilers each have 4,000 sq. ft. of heating and 78 sq. ft. of grate surface. The plant has a single brick chimney 153 ft. high with an inside diameter of 8 ft., and the furnaces are equipped with Sturtevant induced draft. There are three Rice & Sargent engines, two of which are direct-connected to a 750-kw alternator each, one to a 375-kw alternator, and a 400-hp Ames engine is direct-connected to a 250-kw alternator. All the generators are three-phase, 60-cycle machines, built for 2,300 volts. Two of the exciters are motor-driven, with one steam-driven exciter in addition. A Green fuel economizer is installed in the plant, and there is also a cooling tower system used at the peak of the load. Water is drawn from Spot Pond Brook for circulating purposes, and this takes care of about 100 hp of condensing apparatus. City water is used in the boilers. Coal is brought to the plant in wagons, dumped into a crusher driven by an induction motor and then carried to the bunkers by a mechanical conveyor system. The bunkers are located above the boilers, with automatic weighing apparatus and gravity feed. The storage capacity is 390 tons. A 16-ton crane traverses the engine room. The coal consumption of this modern station during the month of November, 1905, averaged 2.86 lb. per kw-hour.

At least twice each day circuits are tested for excessive losses or grounds. At times of light load the fires are banked in the furnaces not in active operation. One boiler is usually cold, for cleaning purposes. The economical operation of the plant is watched largely through the engineer's daily log and monthly report. The daily report blank is reproduced herewith. The power house force works on 10-hour shifts. Drawings and data are filed in fire-proof vaults at the main office.

Malden Electric Company.

Engineer's Report for .....

Cumberland Coal ..... %
Screenings ..... % ..... Total .....
Engine Oil .....
Cylinder Oil .....
Waste—White .....
Waste—Colored .....
Incidentals .....

	STARTED.	STOPPED.	HOURS RUN.
Engine No. 1			
" " 1			
" " 2			
" " 2			
" " 3			
" " 3			
" " 4			
" " 4			
" " 5			
" " 5			

Exciter .....
" ..... hours run. Total .....
No. 1 Feed Water Meter ..... Used ..... Factor .....
" 2 " " " ..... " ..... "
Average Temperature Feed Water .....
Remarks

DAILY REPORT OR LOG.

The Malden Electric Company well illustrates the tendency of central station work to crystallize into a simple output of alternating current only. Not a direct-current motor or lamp is listed on the company's supply mains. The street lighting work is carried out by series arc and incandescent lamps; small single-phase motors are run off the incandescent lighting circuits; 6-amp., alternating-current, enclosed, multiple arc lamps are used in stores and factories; incandescent lighting is supplied at 2,200 volts primary with 110-104 volts secondary leads; and power on a large scale is supplied by 550-volt, 60-cycle, three-phase circuits stepped down from 2,200 volts primary. Large transformers have superseded small scattered units, the former being largely type H General Electric outfits. The company has a private branch telephone exchange at Malden, and all heads of departments are supplied with telephones at the company's expense. If a single new customer should desire power, say, 2,000 to 3,000 ft. from the company's mains, the customer would probably be charged half the total cost of line construction and be reimbursed when four customers are located on the new line. Portable watt-hour meters are used in making service tests.

The local newspapers in the company's territory are employed for regular advertisements, occasionally changed. Electric signs are used by the company at its agencies in the four cities served, and display boards of incandescent lamps are shown with the prices charged for each size. These run as follows for incandescent service:

COST PER LAMP-HOUR AT REGULAR RATES.

2 cp.	4 cp.	8 cp.	16 cp.	25 cp.	32 cp.	50 cp.
.18c.	.3c.	.45c.	.75c	.9c.	1.5c.	1.8c.

At the main office in Malden an extensive display of heating and lighting equipment is made. Double show windows on the street level are utilized to advantage, and the display is changed or shifted about once every two weeks, on the average. During the Christmas season a large Christmas tree was displayed in one of the windows, illuminated in approved style by colored miniature lamps. A flashing sign is used in front of the office and the flasher, motor-driven, is mounted inside so that the public can study its operation in detail. In the office is also a marble switchboard which controls the office lighting. Upon this are mounted watt-hour meters in glass cases, which can be shown to the public and read or explained as occasion arises. Easy chairs, a neat table, settee and several popular magazines increase the attractiveness of the place and render any waiting which may be necessary in meeting appointments far from irksome.

An interesting method of advertising was practiced in 1904 by the company. Each month a 3-in. by 6-in. blotter with a small calendar upon the face was sent to customers and other interested parties. Besides the calendar, the blotter contained pithy comments suitable to the season in regard to the use of electricity. Thus, in January, heaters and sewing machine motors were discussed; in February, incandescent lamp renewals; in March, sewing machines for Easter dressmaking; in April, discounts; in May, June, July and August, electric fans; in September, sewing machine motors; in October and November, lamps, and in December, Christmas tree illumination.

Another effective piece of advertising was carried out by Mr. Ball, of the company, in connection with sewing machine motors. A sewing machine equipped with a 1/30-hp motor, was set up in the window and set in operation, sewing a piece of curtain cloth joined like an endless belt. A great deal of time and trouble was required to find the kind of cloth which would work thus automatically. Finally curtain cloth was found to be successful. The strip of cloth was then printed in large letters to tell the main facts of electric motor usefulness as regards sewing machines. These statements were fed forward one by one as the machine sewed, and they pointed out that a motor of this kind costs $15; that it saves time, trouble and fatigue, and can be operated at an expense of but one cent per hour. The electric signs at the company's agencies, where bills may be paid without taking the trouble to go to the main office, are set up in the form of an incandescent lamp, which can be seen from long distances up or down the street.

The work of soliciting new business in the case of the Malden Company has been carried out in a manner which suggests nothing short of the scientific foresight practiced by the Japanese in the recent war in the Far East. The entire territory has been canvassed with a thoroughness which leaves little or nothing to be desired in the way of information about prospective and actual customers. Two men devote practically all their time to the new business problem, and the data gathered in the campaign are filed on cards in a card index of great value. Each city is provided with a card different in color from the others, and for each building in the territory a card is filled out showing who the owner is, the occupant's name, the use of the building, a brief description of it, the number of rooms, occupant's business, the nearest main, transformer number, whether the building is wired for electricity, whether gas is used, power used, condition as to fixtures, contract data, and appointment and follow-up particulars. Upon the cards as a basis letters, appointments and personal canvassing proceed, and the work is considered complete only when the contract has been signed and the card transferred to another compartment in the index. The officials of the company thus have at their fingers' ends the details of their prospective and existing business.

The storage of lamps, transformers and meters, together with smaller supplies, is carried out in a building close by the power house. Every piece of apparatus is kept in a definite place, and labeled bins are provided for all sizes and voltages of incandescent lamps. On a second floor of this building is a well-lighted and convenient testing laboratory, equipped with a photometer room, high-potential testing set, precision wattmeter and other instruments for meter and lamp testing. Complete card index records are maintained covering all meters and transformers, with their history and tests; special tags are provided for new apparatus and the results of good organization are seen at every side. Monthly statements of transformers and meters are thus easily compiled. A convenient arrangement in the lamp testing room is the rotation of the lamp on the photometer stand by a small motor and the reversal of the rotation periodically.

The rates of the Malden Electric Company for power and lighting are set forth in detail in a small pamphlet distributed to the public freely at the offices, etc. All contracts bear a minimum monthly charge of $1 net. Deposits draw 6 per cent interest and all electricity is sold by meter rates. Incandescent rates for residence lighting are 15 cents per kw-hour from 0 to the first 33⅓ kw-hours burned in any month, and 14 cents for each additional kw-hour. Ten per cent is saved from the gross amount if the bill is paid within 15 days of its date, e. g.:

ASSUME METER READINGS GIVE CONSUMPTION OF 50 KW-HOURS,	
then 33⅓ kw-hour, at 15c	$5.00
16⅔ kw-hour, at 14c	2.33
Total net bill	$7.33
Gross price obtained by adding 10%	.73
Total gross amount	$8.06

The commercial arc lamp rate varies from 7.5 cents to 3 cents per arc lamp-hour, as follows: The first 40 arc lamp-hours burned in any month by each arc lamp installed are sold at 7.5 cents up to 66⅔ arc lamp-hours—called the "primary arc lamp-hours." Above 66⅔ arc lamp-hours the balance of the 40 arc lamp-hours × the number of lamps in service is sold at 7 cents per arc lamp-hour—called "balance primary arc lamp-hours." "Secondary" arc lamp-hours are sold at 3 cents. Thus, assume 6 commercial arcs, each consuming 500 watts. The meter reading gives 300 lamp-hours, for instance. There are then 6 × 40 = 240 primary hours, of which 66⅔ cost 6.5 cents each and 173⅓ cost 7 cents each, leaving 300 — 240 = 60 lamp-hours at 3 cents each. When three or more lamps are used a 5 per cent discount is allowed; if four or five lamps, 10 per cent; if six or more lamps, 15 per cent. The minimum charge is $3 per month per lamp when one lamp only is installed, and $2 per month per lamp when two or more lamps are installed.

The commercial incandescent rates are determined on the basis of from ¾ to ½ cent per incandescent lamp-hour, of 50 watts, the primary and secondary hours being tabulated as follows:

PRIMARY INCANDESCENT LAMP-HOURS PER LAMP PER MONTH:

Jan., 50 hours.	April, 30 hours.	July, 10 hours.	Oct., 40 hours.
Feb., 40 hours.	May, 30 hours.	Aug., 20 hours.	Nov., 50 hours.
Mar., 30 hours.	June, 20 hours.	Sept., 30 hours.	Dec., 50 hours.

Secondary inc. lamp-hours are the excess of the above schedule per lamp per month. The rates are as follows:

Primary incandescent lamp-hours (0 to 666), at	.75 cent.
Primary incandescent lamp-hours (balance), at	.07 cent.
Secondary incandescent lamp-hours, at	.05 cent.

Assume an installation of twenty 16-cp lamps burning in December 2,000 lamp-hours. The primary incandescent lamp-hours are then 50 × 20 = 1,000. Of these 666 are billed at .75 cent, and 34 at .7 cent. The difference, 2,000 — 1,000 = 1,000, is billed at .5 cent. Ten per cent discount from the gross is allowed within 15 days.

"Meridian" lamps for stores are furnished free, and for houses, at cost. Renewals of "Meridian" and other incandescent lamps are free, except that high-efficiency incandescents are not renewed free for residences. The rates for motors vary from 4.5 cents to 1 cent per kw-hour, depending upon the amount of energy consumed, plus a readiness-to-serve charge of $1.50 per hp per month. Advice is freely given to customers by the company.

Wiring With Wooden Mouldings.

By Louis J. Auerbacher.

BEFORE taking up the present subject, the writer will return to the preceding article on "Exposed Wiring," printed in the first issue of last month, several points in which appear to require further explanation. In the paragraph in which fire and weather-proof wire are mentioned in connection with knob and tube residence construction, it should have been added that, though the rules specifically state that only rubber-covered wire shall be used for concealed work, nevertheless, some inspectors pass fire and weather-proof wire, and if permission has previously been given on the ground that such wire is preferable for reasons set forth. In describing the methods of passing wires through floors, as illustrated in Figs. 5 and 6, it was not intended to convey the idea that no additional protection is necessary when running from the floor up the wall, the object being only to describe the methods of passing through the floor. The wires should be boxed in or piped at least 6 ft. above the floor as explained in another paragraph of the article.

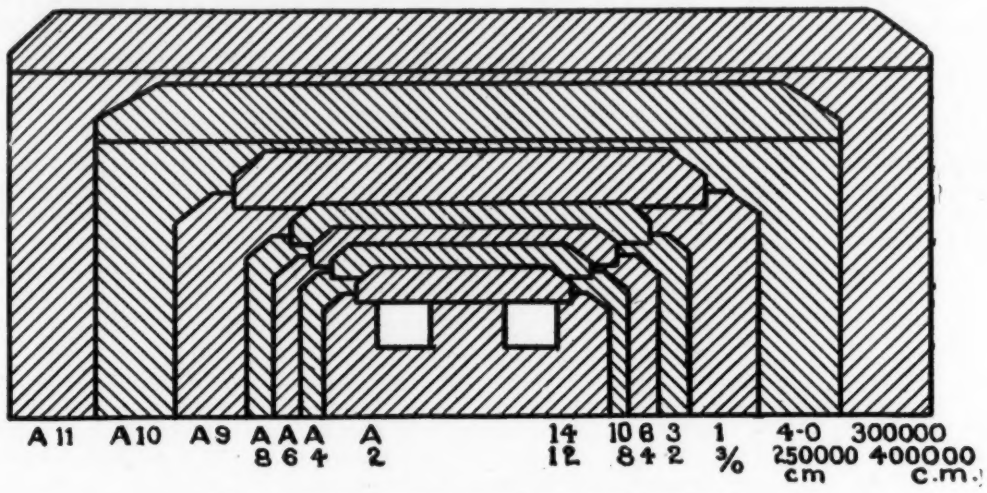


FIG. 1A.—EXACT SIZES STANDARD TWO-WIRE MOULDING.

Wooden moulding is extensively used by the electrical contractor in connection with commercial work in stores, offices and factories. By its use it is possible to make an installation of neat appearance, provided the moulding is run straight and is accurately mitered. Standard wooden mouldings are made in sizes shown in full size and cross-section in Figs. 1 and 1A, which also gives the size of wire each moulding will take. The moulding must have a suitable capping and must conform to the Underwriters' specifications as given in Rule No. 50 of the National Electric Code. Wooden moulding should never be used in damp places, or in buildings subject to fumes, such as stables, breweries, ice houses, etc.; nor should it be used on the inside of the outside walls of buildings, since these are subject to dampness. Wooden moulding should never be concealed and its use in air or elevator shafts is not permitted.

When buying wooden moulding the purchaser should be careful to get only good straight stock, free from knots or other imperfections. The cost of labor required to handle second-class material and "work it in" makes this practice poor economy. A good type of moulding is shown in Fig. 2. The grooves are circular and narrower at the opening than in the center. This form of groove holds the wire in place and enables the wireman to tack the capping without danger of the wire coming down. In the regular moulding, shown in Fig. 3, it is necessary to hold the wire in place with brads.

When laying out a moulding job, symmetrical designs should be followed so far as the distribution of the lighting permits. Where this is done the ceiling presents a neatly paneled appearance, as shown in Fig. 4. Moulding runs should always be finished off. That is, if an outlet is run near one end of a ceiling, "dead" moulding should be continued to the walls so as to give a finished appearance, as shown in Fig. 5.

There are many cases where special mouldings are necessary. This is especially true with private house work, where conditions are such that much fishing is impracticable and cutting is not permitted. The wood of such mouldings should match the wood in the room, and the backing should be made to conform with the Underwriters' specifications. The capping should match the trims or resemble picture mouldings. Various forms of special moulding are shown in Figs. 6, 7 and 8. In Fig. 9 is shown a scheme for wiring a room for picture lighting. The receptacles are stained to match the moulding, which should harmonize with the other woodwork. If neatly done the wiring is concealed so far as appearance goes, and this is the object sought. The feeds are fished, as shown in the illustration, there being very few rooms in which it is not possible to fish the circuit feed wires. A "concealed moulding" method of wiring bracket outlets is shown in Fig. 10. It is, of course, desirable to fish the run from the moulding to the bracket, as shown in the illustration; otherwise, the moulding must be run to the bracket from the main line of moulding around the room.

In combining concealed work with moulding, fibrous flexible tube, such as "Circular Loom" or "Flexduct," should be used. In such a combination no splice box is necessary and single-braided rubber wire may be used throughout.

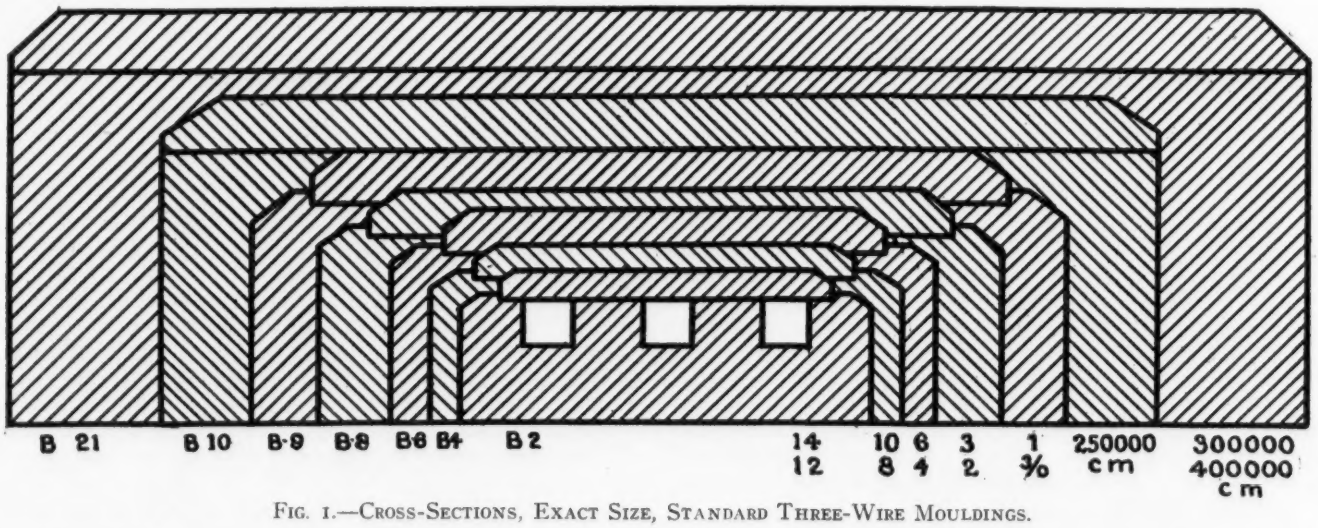


FIG. 1.—CROSS-SECTIONS, EXACT SIZE, STANDARD THREE-WIRE MOULDINGS.

In some cases wooden mouldings are permitted inside of outside brick walls which are exposed to the weather. In such cases a wooden backing one-half inch thick and painted with a moisture repellent, should be first installed and on this the moulding may be placed. Wooden moulding must never be installed in shafts of any kind; iron pipe or flexible steel are the only materials permitted.

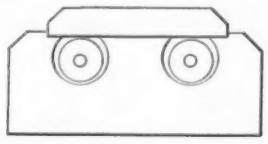


FIG. 2.

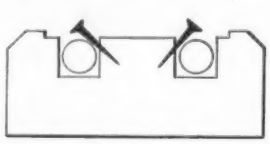


FIG. 3.

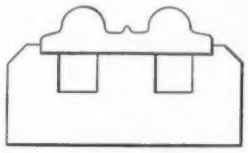


FIG. 6.

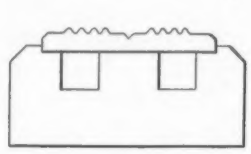


FIG. 7.

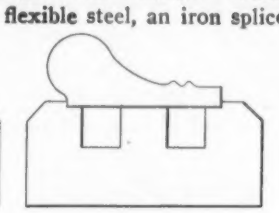


FIG. 8.

In laying out the feeders for a moulding job, it is often cheaper to use iron pipe in a shaft than to run mouldings through the floors of the building. The cost of baring floors and bushing them offsets the additional cost of the pipe, while the contractor is on the safe side and is in no danger of having an inspector compel him to take down the moulding and put up a backing for the reason that the "wall might get damp."

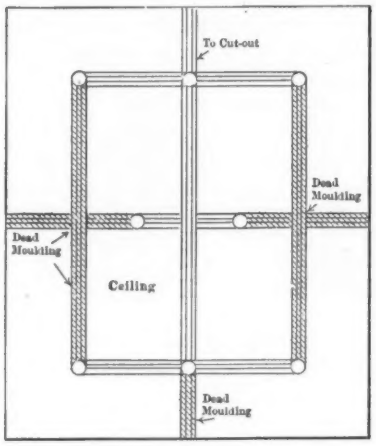


FIG. 4.

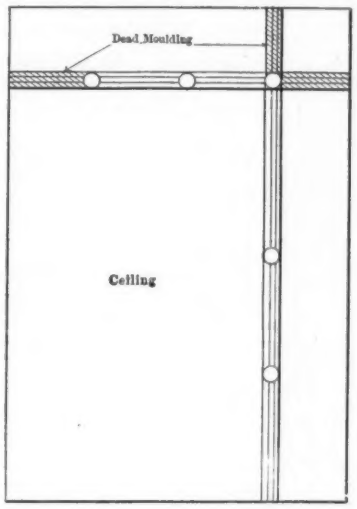


FIG. 5.

Moulding is often used in combination with conduit. When used in connection with solid pipe or flexible steel, an iron splice box is installed where the system of wiring changes. Fig. 11 shows a method of connecting a solid pipe circuit to a moulding circuit. The loom should run up to the moulding. The illustration shows uncovered wire with loom not drawn up tightly, so as to better distinguish the loom. A 4-in. outlet box with cover is used as a splice box, porcelain bushing or flexible tubes protecting the wires leading to the moulding and bushings, and lock nuts being provided on the pipe. When carrying wires from mouldings through floors, porcelain tubes or iron pipe only should be used.

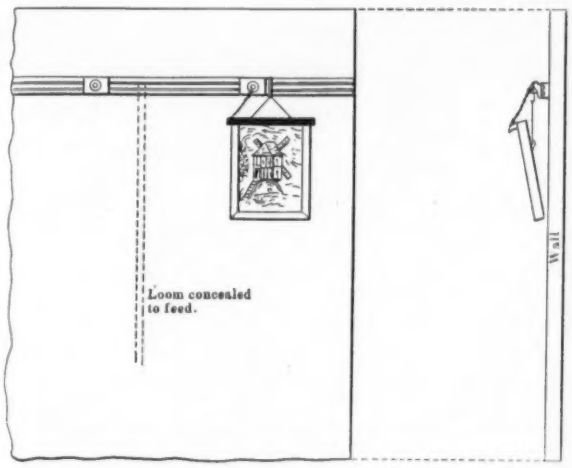


FIG. 9.

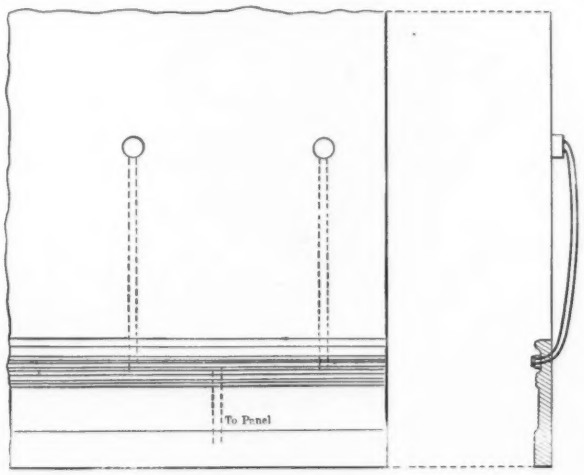


FIG. 10.

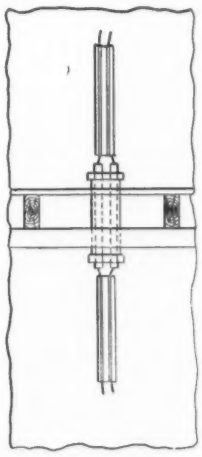


FIG. 12.

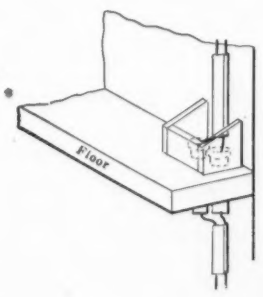


FIG. 13.

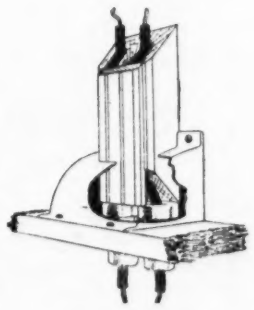


FIG. 13A.

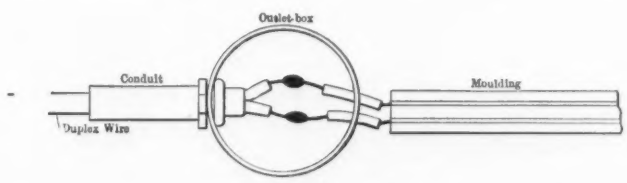


FIG. 11.

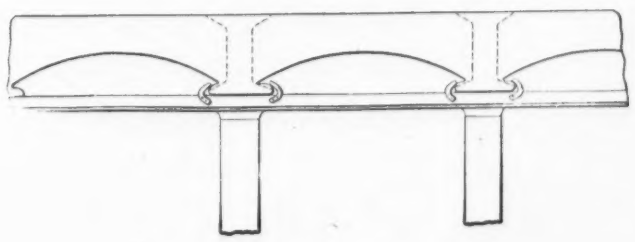


FIG. 14.

This requirement is made by Underwriters for the reason that water used in scrubbing floors will soak through fibrous tube and ground the circuits otherwise encased.

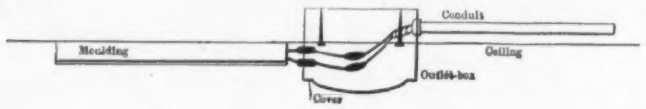


FIG. 15.

Figs. 12 and 13 show proper methods of carrying wires through floors. Where porcelain tubes are used a "kicking" block must be installed to protect the tubes from damage. The loom should be brought close to the moulding, leaving no wire exposed. Illustrations show exposed wire to show the loom better. Fig. 13A shows

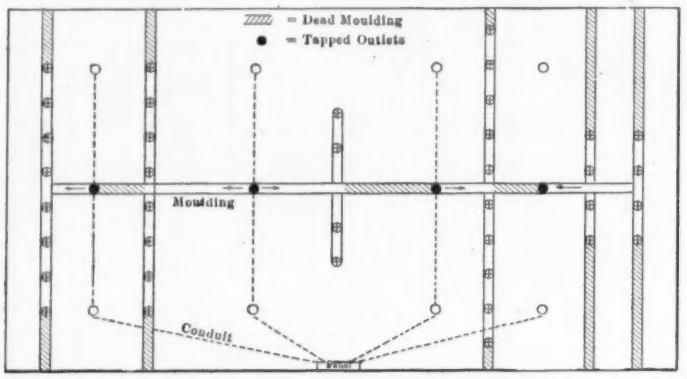


FIG. 16.

a device made for the purpose, which can be obtained at any supply house. When iron pipe is used for the purpose of carrying wires

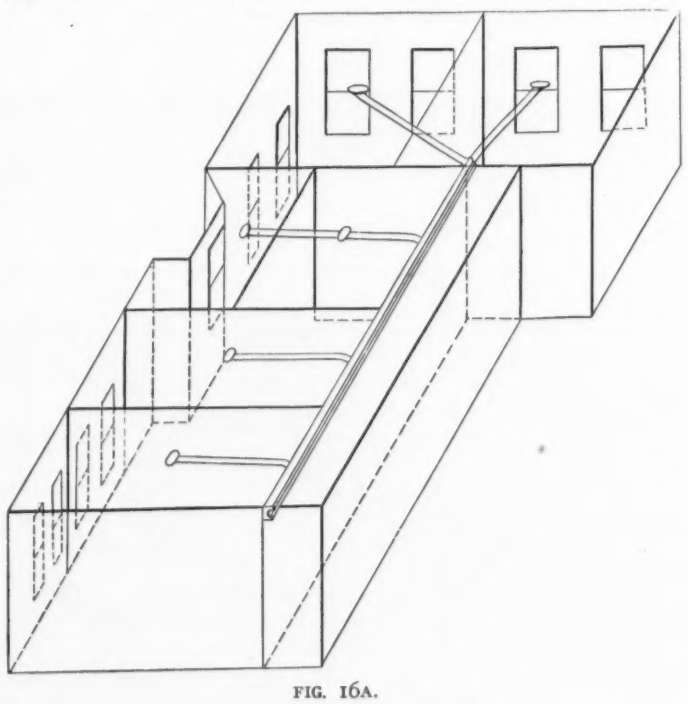


FIG. 16A.

through the floors, as shown in Fig. 13, a flexible tube should first surround the wires. A separate pipe should not be used for each

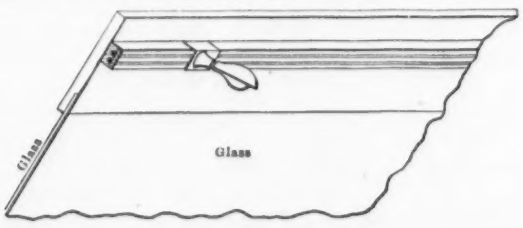


FIG. 17.

wire, since if the current is alternating, induction will result, and the Underwriters maintain that even though direct current may be used when the plant is first installed, alternating current may be substituted at a later period. When passing wires through

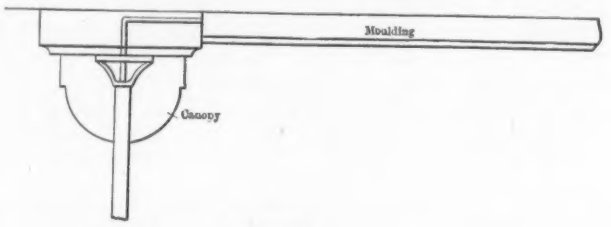


FIG. 18.

walls or partitions, porcelain or fibrous tubes should be used.

In estimating on moulding work, the nature of the surface to which the moulding is to be fastened determines the labor cost. When fastening moulding to lath and plaster, it is common practice to use long thin screws, and this is about 25 per cent more expensive than running moulding over wooden surfaces. Fireproof walls or ceilings, especially those with a wire backing for

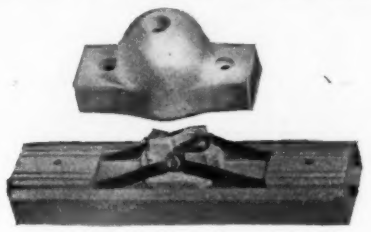


FIG. 19.

FIG. 21.

the plaster, give the most difficulty in fastening mouldings. In such cases it is necessary to drill holes which are then plugged with wood to which the moulding is screwed. The running of a hundred feet of moulding in this manner constitutes a good day's work for a journeyman and his helper.

In running moulding on arched ceilings having exposed I-beams

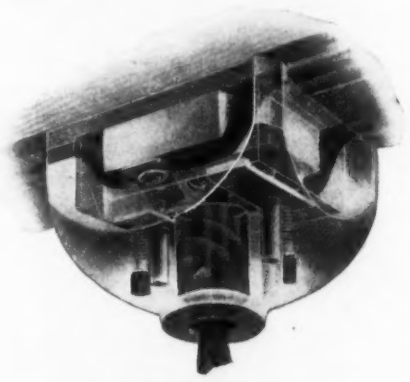


FIG. 20.

clamps are used to fasten the former to the latter, as shown in Fig. 14. In many of the modern fire-proof buildings wired with conduit, the tenants often require a number of drop lights. The circuit feeds are taken from the ceiling outlets and the wires are run in moulding. If the panel has no directory it will be neces-

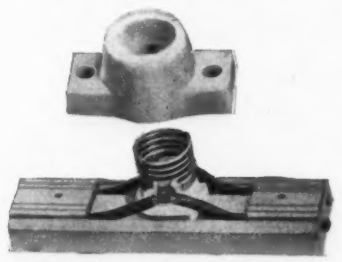


FIG. 22.

FIG. 23.

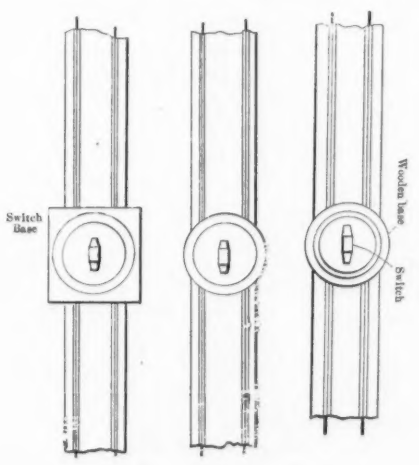
sary to make a diagram of the circuits and tap the outlets in such a manner that the 660-watt limit is not exceeded. When estimat-

ing on such work the contractor should ascertain the capacity of the existing outlets, so that his estimate may be made to cover any additional circuit runs to the panel that may be required. When tapping the outlets for circuit feeds an iron outlet box with cover should be used. The wires in the unused outlets should be taped and caps or covers put over the boxes. Fig. 15 shows a method of tapping the outlet for moulding work, as described. Two long screws hold the one splice box up to the outlet box already installed. The loom should run close to the moulding so as to leave no wire exposed. Fig. 16 shows the wiring scheme of a fire-proof ceiling, in which the existing outlets have been tapped and wire run in the moulding as described. The "dead" portion of the moulding is indicated by the shaded parts.

Moulding wiring is frequently used in combination with flexible fibrous tubing, and for certain finished residence and apartment house work, makes a good, cheap combination. Moulding is used for the circuit feeds, the concealed runs to the outlets being made by wires tapped to the feeds and enclosed in fibrous tubing. As no splice boxes are required, this method is neat and cheap. Fig. 16A illustrates an apartment wired in this manner. If the ceilings are furred, an apartment of this kind should be wired in two days by a journeyman and helper, without breaking either walls or ceilings. The feeds are run up through the halls and cut-out box and meter loop should be provided for each apartment.

Keyless receptacles set on mouldings are used in wiring store windows, where the expense is to be a minimum. An aluminum reflector requiring no shade holder is used. Fig. 17 illustrates this combination. Moulding cut to length, with receptacles and wires all in place, may be made up at the shop and installed in the store window in a short time. The reflectors should not be spaced more than 12 in., and if dark goods are shown or if the window is deep or high, not more than 6 or 8 in. If the frame of the window is not wide enough to conceal properly the lights a curtain should be used; or better still, a dark strip about 8 in. wide may be painted on the window at the top. This strip may also be used as a transparent sign. This method of window lighting gives as good results as can be obtained by the use of mirror-trough reflectors and has the advantages of cheapness and quick installation. Mirror troughs must be made to fit the window, and if run on the sides a template of the miter at the angle must be sent to the manufacturer. All of this, of course, requires time and involves the risk of making mistakes in measurement and of breakage in transit.

Rubber-covered wire only should be used in moulding. Single-braided wire is used in this work. When changing from moulding to conduit, double-braided, rubber-covered wire must be



FIGS. 24, 25 AND 26.

spliced to the single-braided wire for pulling in the conduit. Where fixture outlets are installed, a circular fixture block 4 or 5 in. in diameter should be used. This not only gives a good support for the fixture, but also makes a neat backing for the fixture canopy. The wires are brought through the fixture block, as shown in Fig. 18; otherwise, it would be necessary to cut the canopy and thus disfigure it. Porcelain rosettes for use in connection with drop lights are shown in Figs. 19, 20 and 21. The rosette shown in Fig. 21 can be used either with or without fuses. Those shown in Figs. 20 and 21 are preferable for regular work, since they can be mounted directly on the moulding and at the same time are much neater in appearance. The receptacles shown in Figs. 22 and 23 are used for moulding work. The former is preferable, since it may be installed much more quickly. When installing the receptacle shown in Fig. 23, care must be taken that this is not placed in a position where it is liable to be injured; otherwise, it must be protected by a box.

The snap switches used in moulding work should be mounted

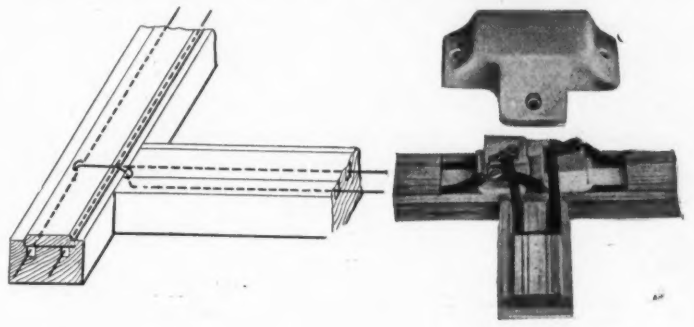


FIG. 27. FIG. 28.

on a porcelain back, as shown in Fig. 24. By using such a back the wires are easily and neatly brought through the switch. Snap switches should not be installed as shown in Fig. 25, that is, directly on the moulding with no back; and if no porcelain backs are at hand the switch should be mounted on a round grooved block, as shown in Fig. 26.

In branching off in moulding work, the tap is made as shown in Fig. 27. A good fitting for tapping circuits is furnished by the porcelain device shown in Fig. 28, by means of which time spent in splicing and soldering may be saved. It is almost needless to remark that if good work is to be done the workmen should be furnished with proper tools, including a good saw and miter box.

Repair Shop Notes.

BY T. BARNARD.

In order to make a success of testing electrical machinery to locate faults, certain special apparatus is very convenient. For the common class of work an auto-transformer is useful, and the details of construction for such an apparatus are given below, in connection with Fig. 1. No difficulty should be experienced in making this apparatus.

We first make our stampings, which may be cut in any tinsmith's shop. There are 300 pieces of armature iron No. 24, 3½ in. by 2 in., and 33 pieces, 7 in. by 2 in. The two legs of the transformer are assembled and pressed to 3-in. thickness in a vise. The best method is to begin to pack stampings together in twos. The second two is placed 2 in. along the first two, and this staggering is kept up until the three inches are made. Usually fifty of these punchings are required for one inch. They are then bound up with a piece of wire and are ready to place on the insulation. It will not be necessary to provide insulation between the stampings, since the apparatus will only be used intermittently. To insulate the core is bound up with about three layers of strip cotton and then varnished. A good quality of cardboard is next bound down with cotton and varnished. This will prevent injury to the wire when bending around corners in winding. The core is insulated to within 2 in. of each end, leaving 5 in. of winding space in the center. For 110 volts, 60 cycles, alternating, there are twenty sections in the winding, or ten on each leg. Each section of twelve turns is wound three wide and four deep. After being thus wound the two legs are placed together and their windings connected in series, care being exercised that no sections are connected in opposition. The small "keeper" stampings must then be put in position, and care must be taken that they are not driven into the windings.

After the transformer is thus assembled it should be connected to a controlling switch for the regulation of the testing e.m.f. It will be noticed that every button of the switch is a dead one, thus preventing a section from being short-circuited by the switch contact.

The first test to be noted is that of an armature, as in Fig. 2. The leads are contacted at the brush positions of the armature, diametrically opposite in the case of a bipolar, and 90° apart in the case of a four-pole machine, and so on. A telephone receiver is used, the sound therefrom indicating the condition of the coil insulation between the bars, the telephone contact being made between adjacent bars. The voltage should be adjusted so that a fairly loud hum will be heard in the telephone

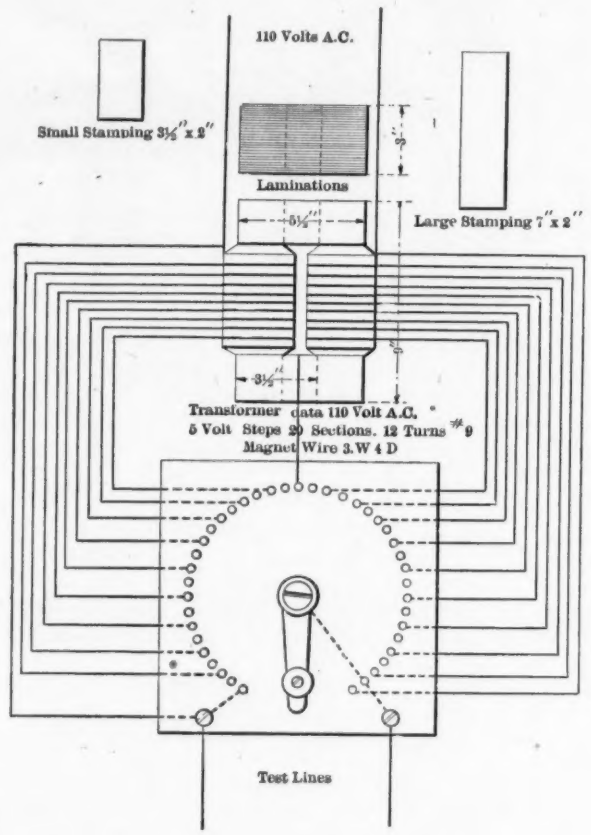


FIG. 1.—CONNECTIONS FOR TESTING.

receiver. If the coil is short-circuited the hum will be reduced in loudness and sometimes not be audible. If there is an open circuit at the bars tested an excessively loud hum will be heard. A little practice will soon make one confident in carrying out these operations. A current indicator (marked *A* on Fig. 2) or

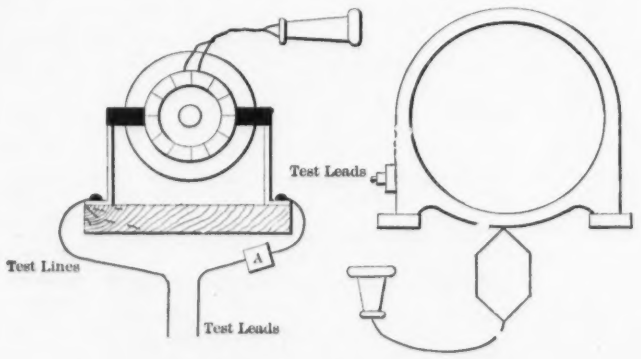


FIG. 2.—TESTING AN ARMATURE.

a low-voltage glow lamp will show whether the armature is short-circuited between coils, the lamps brightening up at a short-circuit. In this case the voltage at the transformer should be about that of the lamp. By this method a fault may be usually located within one or two coils without breaking the connections of the armature. Sometimes a commutator fault consists merely in the presence of particles of metal between segments, and if the transformer is adjusted to five or ten volts, these may often be burnt out without doing any harm to the commutator, thus saving much time in locating and picking them out. In testing out the winding of an induction motor an exploring coil arrangement should be made to span the phases. When a current is sent through the different phase windings, a distinct hum should be heard at every pole. This method saves much trouble in testing out polyphase windings. I have used the tests above described and have found them quite satisfactory.

The Rome, N. Y., Gas, Electric Light and Power Company.

The Rome Gas, Electric Light & Power Company controls the entire gas, electric light and power business at Rome, N. Y., a city on the main line of the New York Central & Hudson River Railroad having about 20,000 inhabitants. The gas and electric light stations are located on the Erie Canal, and the local offices of the company are situated on North James Street. The company has a perpetual gas franchise, owns over fifteen miles of mains and has an annual gas output of over 32,000,000 cu ft. The net prices of gas for light and for fuel are $1.50 and $1.20 respectively. The equipment at the electric generating station consists of three 150-kw, three-phase, 2,200-volt, 60-cycle revolving-field alternators, one 50-kw, 500-volt, direct-current generator, one 75-hp, 220-volt, three-phase motor, Russell engines and Stirling water-tube boilers.

At present affairs at the station are in more or less of a transition state, it being the intention to shut down the station shortly and use energy from Trenton Falls. For this purpose three 500-kw, water-cooled, oil-insulated transformers are being installed to step down the 20,000-volt current to 2,000 volts for distribution over the company's lines. The transmission lines run from Trenton Falls by way of Utica. The poles, which are 71 ft. 6 in. long and stand 64 ft. above ground, are already erected, and, in about another month the company expects to be able to shut down the generating equipment at Rome, and convert the station into a sub-station; the present equipment, however, will not be scrapped, but be held in reserve for emergency use.

The distribution circuits are all overhead, and alternating-current is used almost exclusively, transformers on poles stepping down the voltage for commercial use where necessary. The company has a six-year contract to light the city on an all-night basis with 6.6-amp. enclosed arc lamps at 31 cents per lamp per night or $113.15 per lamp per year. The streets are heavily shaded by trees so that in most cases the lamps are suspended over the middle of the roadway. Commercial lighting is done by about 4,000 16-cp, alternating-current incandescent lamps.

For getting new business the company employs two solicitors, who devote their time mostly to increasing the power load. Advertisements are carried in the daily papers, pamphlets are occasionally distributed, and bill-board and pole advertising are resorted to. Pole advertising is devoted chiefly to increasing the sale of coke, which is a by-product of the gas works. Four incandescent lamps, two on each side of the pole, are so placed that persons walking up or down the street have their attention directed to a lighted sign on which is clearly printed in Gothic letters "Coke" or "Use Coke for Fuel." Every pole owned by the company and situated on the main thoroughfares is thus equipped. Little seems to be done to increase the sale of electric energy for domestic lighting. The office of the company is brilliantly lighted at night by numerous forms of Welsbach mantle lights situated along the walls and by Meridian electric lights which stud the ceiling. Gas arc lamps are used outside the building in front of each window and a large electric sign advertising coke is placed on a post at the curb. Gas fixtures, stoves and appliances are on display. The company finds a greater demand for gas for lighting and cooking purposes.

The company carries out inside construction and wiring, be-

sides selling motors and appliances. Electricity is sold by meter, the rates to consumers using energy for lighting and power for motors of one horse-power and less ranging from 15 cents per kw-hour to 11 cents, depending on the quantity used. A discount of 10 per cent is allowed on all bills paid on or before the 10th of the month following that in which electric energy was consumed. The minimum charge for electric service per month is one dollar. Some direct-current at 500 volts is used for power. The service is maintained from 7 o'clock in the morning until 6 o'clock at night, Sundays and legal holidays excepted. The company is discouraging the use of direct-current for power purposes and will not accept any new business nor extend any service on this system. The rates vary from 5.96 cents per hp-hour to 2.38 cents and a discount of 5 per cent is allowed on all bills paid on or before the 10th of the month. A minimum charge of 20 cents per hp per month is made on all motors larger than one horse-power for "readiness to serve" where the motor remains connected to the company's lines. Special inducements are now being made to consumers of alternating-current for power, and the alternating-current power load has trebled within the last six months. In fact the demand for 60-cycle alternating-current for power has far exceeded the supply, and the company is holding off prospective customers until the line from Trenton Falls is complete. The rates vary from $.0596 per hp-hour to $.0125, depending on the quantity consumed. Prompt payment is rewarded by a discount of 5 per cent, and a minimum charge of 20 cents per horse-power per month is made on all motors larger than one horse-power for "readiness to serve."

As is frequently the case where gas and electric plants are combined, it would appear that the interests of the electrical department suffer so far as relates to incandescent lighting, being considered merely as an auxiliary for arc lighting and power service.

The company is controlled by the United Gas & Electric Company, of Detroit, Mich. The president of the company is Mr. James T. Lynn, of Detroit, Mich; Mr. R. A. Field, of Rome, is superintendent; Mr. C. Chambers, chief engineer, and Mr. T. Lynch, chief electrician.

Advertising Follow-Up Methods for Central Stations.

BY FRANK B. RAE, JR.

A follow-up system is built upon the same principle as a bulldog. It is founded on the never-let-go theory which presupposes the recipient of the follow-up matter to be a prospective customer who in time may be persuaded, argued, enticed, or hectored into buying. The system is designed to place selling arguments before the prospective buyer from twelve to fifty times a year. This cannot be done by a solicitor except at prohibitive expense. It can be accomplished successfully by following-up for from half a dollar to two dollars per prospect per year.

The follow-up advocate takes it as granted, before he puts his system into play, that each prospect is "alive," and that in order to bring him into line, it is necessary to:

(a) Supply complete information touching the product for sale, its uses, advantages and superiority.

(b) Appeal to the thriftiness and home pride.

(c) Overcome prejudices, just or unjust, which may exist against the advertiser.

(d) After the prospect is otherwise won, overcome the common failing of procrastination and close the sale.

He does this by a series of direct-by-mail advertisements which aim to touch successively each chord until the prospect surrenders. Theoretically, he perseveres till the prospect buys or dies.

Follow-up methods are as various as the men who design them, but it is safe to assert that, in the case of central stations, no such scheme will be successful which does not embrace the co-operation of well-drilled solicitors and friendly newspapers; or which is not well and carefully planned and systematized in advance of the first mailing. A disjointed succession of diversified mail-cards, folders and letters does not constitute a follow-up system. It cannot be counted upon to give consistent, dependable results. At best, it is but a hodge-podge, issued hurriedly and at random, or when other business is pressing, not issued at all.

As a preliminary to any aggressive follow-up campaign for business, the newspapers should be cultivated. They should be supplied with non-technical news items on electrical subjects of interest to their readers; with information on which to make announcements of improvements in the local plant, any reduction in rates, extension of lines, or other improvement and requested to add comment, pointing out that the company is voluntarily and aggressively bettering its service. This may look like a long order to some lighting companies, but it is worth all it costs, especially now, when the public is being lashed to a fury against utilities corporations, the "money power" and the "trusts." The purpose of favorable newspaper comment is to prepare the way for favorable or, at the worst, neutral reception of the follow-up matter; for without such neutral reception, your advertising will have the double duty of first overcoming whatever prejudice may exist against the company, and then persuading the public to get on circuit.

The actual follow-up matter should be planned, prepared and systematized with very strict regard to local conditions, the attitude of press and public, and the class or classes of people who are being solicited. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used; in the careful manner in which inquiries are to be acknowledged and followed, and in strict adherence to both the condition and the policy of the company. All the various mailing cards, letters and folders should be written and designed in advance. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitors' labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is issued. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully checked, followed and reported upon and that the enthusiasm of the soliciting force is kept at red heat.

When it is understood that the chief object of the follow-up is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always enthusiastic, always aggressive, will be appreciated. To be sure, the advertising will bring many voluntary contracts to the office, but the campaign should be educational rather than importunate; it should be tactfully insistent in presenting the advantages of central station service, rather than bluffly demanding business. The actual business-getting must, and always will, remain with the soliciting force. Advertising was never intended for, and never successful in, actually making sales except in the case of "mail-order" propositions.

The follow-up method, so far as the central station is concerned, is merely an advertising plan whereby you regularly, persistently and effectively keep the advantages of your service before every prospective customer within reach of your mains. That good follow-up is good and that poor follow-up is bad, has already been shown by the experience of several well-known lighting companies. That the method can be adopted with profitable results by the smaller plants has also been demonstrated. Invariably, when the scheme has failed to give the expected returns, the failure has been in the early planning. It may be made too elaborate, or too voluminous. It may contain too much bulldozing. It may be wasted upon ill-chosen lists. Most serious of all, it may be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience.

Such faults should not be charged to the method, but to lack of skill in installing it. For in the last analysis, follow-up means simply organized advertising as opposed to a hit-or-miss lack of method in advertising, and as such is adaptable to any station where there are a hundred prospective customers.

Central Station Notes From Belvidere, Ill.

Probably the point of most general interest to other central station men in the recent work of the Belvidere, Ill., Gas & Electric Company is the remarkably successful and rapid introduction of electric flat irons in a town of 8,000 population. Last summer, Mr. C. L. Powell, general manager, sent out 50 General Electric flat irons to a list of customers selected at random. These flat irons were accompanied with a circular letter to the effect that the company felt that the electric flatiron was a device of such merit that it wished its customers to give it a trial and was sending one for trial. If for any reason the iron could not be used, the company would take back the iron, otherwise it would be put on the next month's bill. Out of this first 50, only four came back for various reasons. Soon after this set of irons was sent out, a lot of other customers came in, who felt rather slighted that they had been omitted in the first distribution and more irons had to be ordered immediately. The company now has about 75 electric flat irons on its line. The town has proved such a good place for electric heating that one of the electric meter manufacturing companies has arranged to have its own solicitor canvass the town with, of course, the co-operation of the central station company. A number of Simplex irons and other heating devices are in use.

Mr. Powell, manager of this plant, is also general manager of the Owatonna Gas, Electric & Heating Company of Owatonna, Minn. This company was sent 10 irons and they took so well that the local manager immediately sent back word to send 50 more.

These flat irons are, of course, placed on the regular residence lighting circuits and pay the regular rate. Besides flat irons there are about 25 curling iron heaters in use and several heating pads and coffee percolators. The company is now after a contract with a laundry. Under this contract, if it is secured, the laundry irons will be put upon a special meter.

The system of charging is similar to the two-rate scheme used in Cleveland, Ohio. The base rate is 20 cents per kw-hour, which is subject to a 25 per cent discount on the full rate portion of the bill, in consideration of prompt payment. For all power used in excess of 1,500 watt-hours per month per 16-cp lamp connected (about 30 lamp-hours), the rate is 7 cents per kw-hour. The power rate is 8 cents net for motors up to 25 kw-hours per horse-power connected, all over that being 4 cents per kw-hour.

In figuring the connected load in residences, only one-half of the actual connected load is taken. Heating and electric sign work is not figured on connected load.

The company does hot water heating under the Yaryan system, Mr. Powell, the manager, having formerly been connected with that concern. The hot water rate is 20 cents per square foot of radiation connected per season. A thermostat for automatic control is placed in each customer's service pipe.

The lighting and power is all done from two-phase, 2,300-volt generators. Although power for lamps and motors is supplied from the same bus-bars, separate feeders are used for the two purposes. The power house supplies also direct current to the local street railway and for a part of the interurban mileage between Belvidere and Rockford.

Business is increasing faster than it can be taken care of. The company does most of the new wiring and electrical construction work in the town, but would be glad to turn it over to a responsible contractor who would work a sufficient number of men to keep up with the demand.

Belvidere is not a remarkably good town for power, aside from the National Sewing Machine Company's large factory, and this has its own plant. The connected load in motors is 135 horsepower. There are about 1,100 elctric meters connected. The company is beginning to push electric signs and now has seven or eight. It does not furnish free renewals of incandescent lamps, but sells lamps to customers at 20 cents each. So far it has been able to keep cheap low-efficiency lamps off of the circuits by refusing to be responsible for inferior results as to lighting or dissatisfaction as to the size of customer's bills, if the customers insist on purchasing cheap lamps.

Advertisement Writing Contests.

One of the oldest and best advertising schemes on record is that of inaugurating prize advertisement writing contests. While hoary with age and threadbare from long usage, the idea persists, and with each repetition proves its value as a means of interesting a large number of people in the product advertised. Those who demand always the original, the extraordinary in advertising will not take kindly to a revival of the old advertisement contests for school children; yet in what way can we bring a knowledge of electricity as a home necessity closer to our public than by these means?

The whole aim and end of advertising is to spread the advantages of a product before the public, and we perform many strange feats to accomplish this end. The advertisement writing contest leads not only to the rapid circulation of the desired facts, but to a close and friendly study of the product by the public. And in limiting the contest to school children, we immediately interest every mother, father, uncle, aunt and all the tribe of elder brothers, sisters, cousins, friends and fiances. The resultant advertisements are pretty sure to be valueless, *per se*, but the names and addresses secured in this manner are of value if carefully followed up.

The following advertisement which appeared in the San Francisco Gas & Electric Company's bulletin, *Gas & Electricity*, shows how this progressive company adapted the scheme for its gas department. It can be used to promote interest in electric lighting with equal success:

ADVERTISING CONTEST.

Last month was inaugurated an ad-writing contest, which is proving of great interest and value to school children. This was directed to school children who wrote the best advertisement for the gas range, the great labor-saver and economizer. We wish to include in this contest the best short articles from the users of gas ranges. If you have used a gas range, and find that it saves labor, dirt and expense; that it bakes and broils better; that your gas bills are $3 a month, whereas your coal bills were $5.00, write a concise, interesting article about it.

Ideas are worth money to us, and we offer grand prizes for the accepted article or ads. Many ads have been received, but as so many of our customers are in the country, the decision will be delayed until August 15th, when the contest will be decided by a committee of leading newspaper men. The first prize is a $20 gas range. The second prize is a $14 gas range. Address all communications, to etc."

A Clever Plan for Securing Good Advertising Copy.

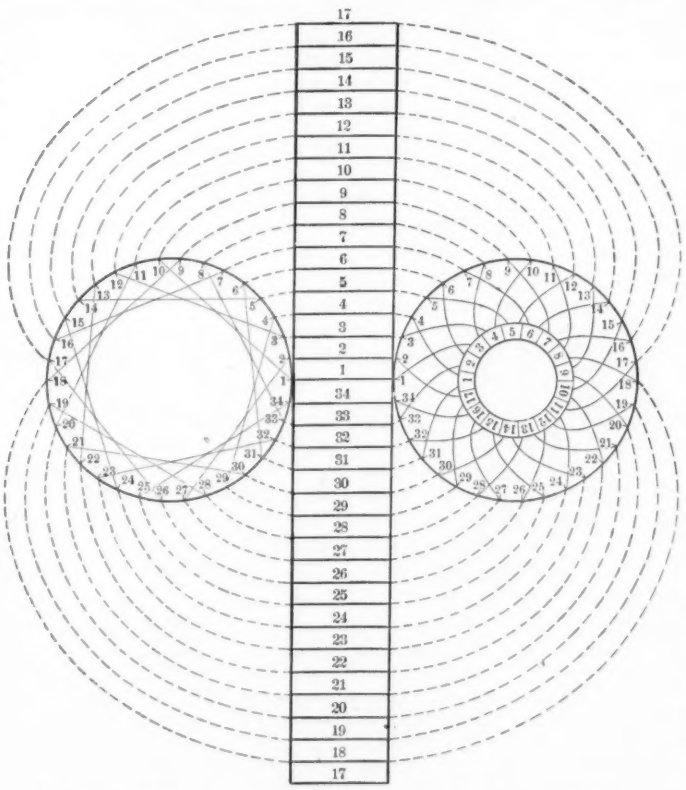
Every station manager who uses the newspapers, either from choice or policy, knows the annoyance, and even hardship, on having to prepare new and effective advertising copy each week. It is one of the most harassing of his manifold duties—which may account in some measure for the large number of mediocre electric light advertisements that appear in various parts of the country. The problem has been cleverly solved by Mr. J. E. Montague of the Niagara Falls Light & Power Co. The Niagara company employs three solicitors, and to these he delegates the task of writing, requiring each one to submit copy for the several weekly papers.

Naturally there is a considerable amount of rivalry, which results in the production of some very effective advertisements. The idea is one which may be adopted with good results by other managers. The solicitors being constantly "on the firing line," are particularly qualified to suggest the most salient and telling arguments in favor of the service. It only remains for the manager to coach them in a direct and forceful manner of expressing these arguments, to produce the very best class of electric light advertising.

LETTERS ON PRACTICAL SUBJECTS.

SIMPLE METHOD OF REPRESENTING ARMATURE WINDINGS.

I submit herewith a scheme of representing a simple loop winding on a four-pole machine, which is entirely new. It will be noticed that the diagram is very simple in idea, being merely the development of the armature as a cylinder with the slots numbered and having the commutator segments numbered also. The principal advantage of this method is that it is not necessary to draw the armature in any way out of proportion; but everything may be represented just as it is, and drawn to scale if necessary. By this means no false impressions are conveyed to the mind of a beginner, which I know from experience is often the case with other methods. It is evident from the diagram that any style of winding, however complicated or simple, may be shown by this method with equally good results. I have chosen the loop winding because it serves the purpose I have in mind just as well as a more complicated winding, and requires less time. It is very easy to trace the connections when the slots and segments



SIMPLE METHOD OF REPRESENTING ARMATURE WINDINGS.

are numbered as shown. In the case illustrated the armature has 34 slots; the commutator has 17 segments; the back pitch is 9, the front pitch 7 and the commutator pitch 1. The winding starts from commutator segment 1, passes to slot 31, then to slot 6 and back to commutator segment 2; it being a very easy matter to count the pitch in this diagram. Denoting the segments by *C* and the armature slots by *S*, the complete scheme is as follows:

C	S	S	C	C	S	S	C
1	31	6	2	2	33	8	3
3	1	10	4	4	3	12	5
5	5	14	6	6	7	16	7
7	9	18	8	8	11	20	9
9	13	22	10	10	15	24	11
11	17	26	12	12	19	28	13
13	21	30	14	14	23	32	15
15	25	34	16	16	27	2	17
17	29	4	1	1	31	6	2

From this it is evident that the winding comes back to its original starting point, thus proving this scheme true. In summing up the advantages of this method over others, I should mention—1, its extreme simplicity; 2, its ability to be drawn accurately and to scale; 3, its ability to represent with exactness the position of commutator segments, armature slots and winding at the same time, and through these advantages, 4, the saving of time, space and worry. I believe that instructors of electricity will be glad to know of this method as well as others. One instructor in Baltimore to whom I have shown the scheme uses it with much greater success than with others.

BALTIMORE, MD. EDWARD K. STEMBRIDGE.

SINGLE-PHASE APPARATUS AND THE SMALL CENTRAL STATION PLANT.

Probably the majority of small central stations of this country operating in towns of 3,500 population or less are still using single-phase, 125-cycle apparatus for lighting. It goes without saying that the plants using this apparatus either have some direct-current apparatus for taking care of the power business or they have no power business at all save a few fan motors. Many of these stations are beginning to consider changes which will enable them to handle power business either by 500-volt, direct-current or from their alternating-current circuits. Many of them have been preparing for a change to 60-cycle generating machinery for some time, by putting in transformers suited to the lower frequency. The principal question that will have to be met when the change to the lower frequency for power purposes is made is whether to put in single-phase, two-phase or three-phase apparatus. The question has many sides to it and it is hoped that those who have given it thought will present their conclusions for the benefit of central station men. To invite discussion the following considerations are presented:

The simplicity of the single-phase apparatus is undoubtedly desirable, especially in small plants where there may be difficulty in balancing up a load between two or three circuits. It is undesirable to run two or three wires to every power customer; it is further undesirable to install two or three transformers for a power customer where one would do. As far as the question of distribution alone is considered, the single-phase system is far preferable. It therefore simmers down to a question of motors. Single-phase induction motors have been on the market for some time for constant-speed work which in performance are fully equal to two or three-phase induction motors, although not quite as simple as the two or three-phase motors and a little higher in first cost. On variable-speed motor work such as cranes and elevators both the single-phase and the polyphase systems have been at a disadvantage as compared with the direct-current type. Recent developments in the shape of elevator and crane motors having all the characteristics of series direct-current motors have given the single-phase system, if anything, a little advantage over the polyphase system, and in fact have placed it almost on a par with the 500-volt, direct-current system for scattered work in small towns. At the present time direct current has the advantage as to low cost of motors, two and three-phase induction motors coming second and single-phase motors coming last on this basis of comparison.

It is, therefore, up to the owner of the small alternating-current plant who is going into the power business to decide whether to adhere to the simple and flexible single-phase system with its high-priced motors manufactured by only two or three concerns, or to introduce the complications of the two or three-phase systems for the sake of cheaper motors, or as a third way out of the difficulty, put in a 500-volt, direct-current power service, apparatus for which can be obtained very cheaply in either the new or second-hand market. As far as simple distribution is concerned the 500-volt direct-current system in a small town offers probably fewer complications than the polyphase system. Its chief disadvantage is at the power station where two kinds of generating machinery must always be kept in operation. In a small plant this is an even greater disadvantage than in a large plant. With single-phase apparatus developing as rapidly as it is at the present time, the owner of a small central station about to put in a power service may well do some hard thinking before deciding to adopt some other system for his power service if he has a single-phase distribution already in operation.

CHICAGO, ILL. CHAS. L. JAMESON.

GROUND DETECTORS AND THEIR CONNECTIONS.

I note an error in the connections in the illustration (Fig. 1) of a ground detector printed in your December issue. The right-hand binding post of the Stanley ground detector should be connected to stationary vanes 1 and 4 as shown by Fig. 2 herewith, and the left-hand binding post of the instrument connected with vanes 2 and 3. Consider that at a given instant line *B* is positive and that this same line is grounded. With the connections as shown in Fig. 1, line *B* is positive, and the upper side of the condenser negative. By induction, plates 2 and 3, to which the right-hand binding post is connected, would be positive. Plates 2 and 3 and the top portion of the condenser form an insulated system. The positive charge on the lower portion of the condenser, which is directly connected to the line wire, attracts a negative charge on the top portion of the condenser. The top

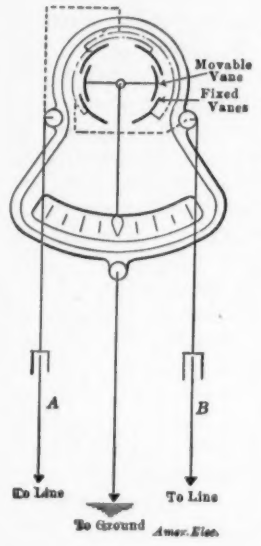


FIG. 1.

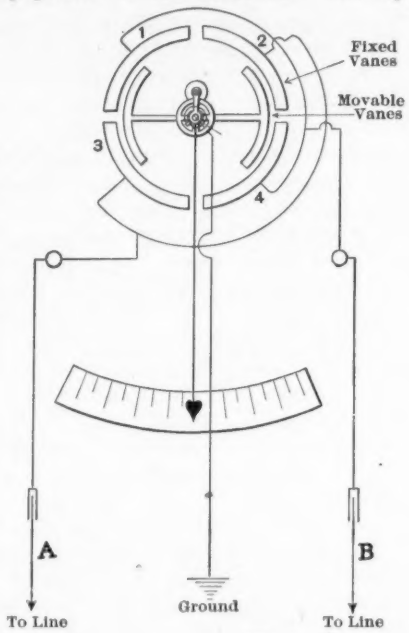


FIG. 2.

portion of the condenser is at one end of the system, and therefore a positive charge is set up at the distant end of the system on stationary plates 2 and 3. The author states that "if the ground is on line *B*, the pointer deflects to the right." Now, as line *B* is grounded, the movable vanes will have a plus charge, because they are connected directly to the ground. There will be repulsion between the movable vanes and vanes 2 and 3, as these latter are positively charged, and the movable vanes are also positively charged. Therefore the movable vanes will rotate in a clockwise direction and the pointer attached to the movable vanes will be moved to the left and not to the right. If the connections are changed so that the right-hand binding post of the instrument is connected to plates 1 and 4, and the left-hand binding post to plates 2 and 3, then plates 1 and 4 would be positive when the line *B* was grounded and a positive current was flowing in the line; the repulsion between plates 1 and 4 and the movable vanes would cause a counter-clockwise rotation of the movable vanes and the pointer would deflect to the right.

Scranton, Pa. Francis H. Doane.

IMPROVED METHOD OF INSTALLING KNOB AND TUBE WIRING.

We note in connection with Mr. Auerbacher's article on "Exposed Circuit Wiring," published in the January 6 issue of the Electrical World, that the holes in Fig. 1 are drilled at an angle by the ordinary brace and bit. We do considerable wiring work, and while we find the article pretty thorough, this method of boring holes is, in our humble judgment, quite antiquated. With the many patent boring machines now on the market, it is possible to bore holes straight and in line, thus not only saving much unnecessary pulling and straining of wires, but at the same time saving about 10 per cent in the amount of wire required. We are of the opinion that many electricians, especially in smaller towns, would be benefited by using these improved boring machines.

Oran, Mo. Scott County Telephone Company.

THE CARE OF COMMUTATORS.

It is well known that some commutators will run for years with almost no attention, while others need constant attention to keep them anywhere near good condition, and even with good attention they are not very satisfactory. The fact is that successful operation of a commutator is dependent on certain inherent qualities in the machine, rather than on the care which is bestowed after it is built and is in operation. There are cases in the writer's knowledge where railway generators subjected to heavy overloads at times have operated over periods of four or five years, without even having the commutators so much as sandpapered, and with less commutator care than any other machines operating an equal number of months. Upon inquiry as to the care given to the commutators it was learned that they had very little care; in fact, the least of any machines in the station. About all that was necessary was to keep the commutator clean and perhaps wiping with a very little of some kind of lubricant at intervals. The best way to stop sparking at the commutator is to have the proper design of machine in the first place; assuming of course that the machine is provided with good brushes and brush holders that will not chatter and that the brushes are placed at the neutral point. When these are provided, the performance of the commutator is largely dependent on the inherent qualities of the machine rather than upon the amount of care the commutator receives in service. It goes without saying also that once a commutator's surface is in bad condition, it will rapidly get worse, and here is where "A stitch in time saves nine."

Chicago, Ill. J. C. Randall.

INSTRUMENT FOR LOCATING SHORTS AND HEAVY LEAKS IN ELECTRIC CIRCUITS.

Fig. 1 herewith shows a simple home-made testing instrument for locating shorts and heavy leaks in electric circuits which will doubtless be of interest to your readers. I have used an instrument of this kind for many years with excellent results, and in fact any one with the slightest knowledge of elec-

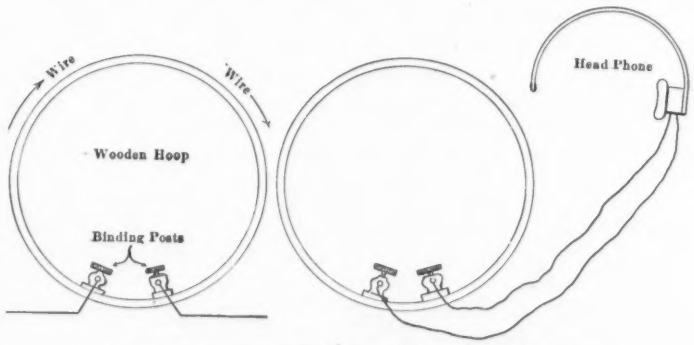


FIG. 1.—INSTRUMENT FOR LOCATING SHORT-CIRCUITS.

tricity and engaged in trouble or repair work will find the instrument of great value. A wooden hoop 12 ins. in diameter is fitted with two ordinary binding posts as shown. Around the outside of the hoop is wound one pound of No. 25 single-cotton-covered copper wire as indicated by the arrows. After the coil is wound, it should be well shellacked and covered with tape in order to keep the wire in place on the hoop and also to protect it from mechanical injury. In connection with the hoop the operator should procure a head 'phone receiver, since this is more convenient than the ordinary watch-case receiver, and a small bee-hive buzzer. The receiver should be connected to the binding posts on the hoop, as shown in the sketch on the right, the cord being sufficiently long to enable the operator to manipulate the hoop conveniently.

When testing for shorts or leaks on gas lighting or bell circuits, it is taken for granted that the operator will make sure that the batteries are in good working order. In testing for a grounded wire, a circuit is completed through a water or gas pipe, buzzer, battery and the defective circuit. The vibrations of the buzzer cause an interrupted current to flow over the line. By placing the receiver to the ear and holding the hoop where the buzzer is connected to the line the vibrations may be distinctly heard in the receiver. By following wherever

the sound leads, the direction of the circuit is easily ascertained. Where the sound becomes weakest and almost indistinct is the location of the defect. This test may also be made on electric light circuits. In a store where there are many lights on a circuit, such troubles as punctured insulation, short-circuited sockets and switches, require some little time to locate ordinarily, especially if the switches are in gangs. By the use of this instrument

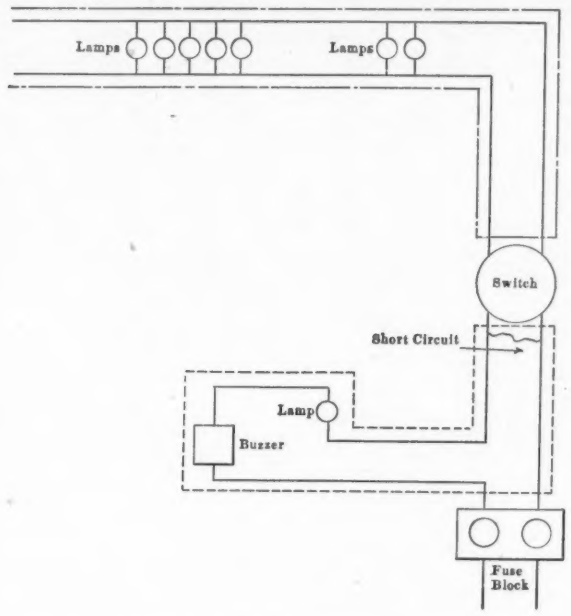


FIG. 2.—LOCATION OF SHORT-CIRCUIT BY INSTRUMENT.

the exact location of the defect is quickly ascertained. In decorative work where a number of streamers are run, each with a large number of lights, a defective lamp or socket causes a great amount of trouble, especially if the time is limited. With a coil of this kind, however, the fault is located in less time than it takes to tell. In making these tests, two dry batteries are placed in series with the buzzer on that line or an incandescent lamp in series will give the same results. At the place where the interruptions of the buzzer cease, the line is short-circuited.

This is illustrated diagrammatically in Figs. 2 and 3, which show a short-circuited switch and electric-light fixture respectively. In Fig. 2 the buzzer is in series with a lamp on the short-circuited line. The dotted lines indicate the travel of the sound;

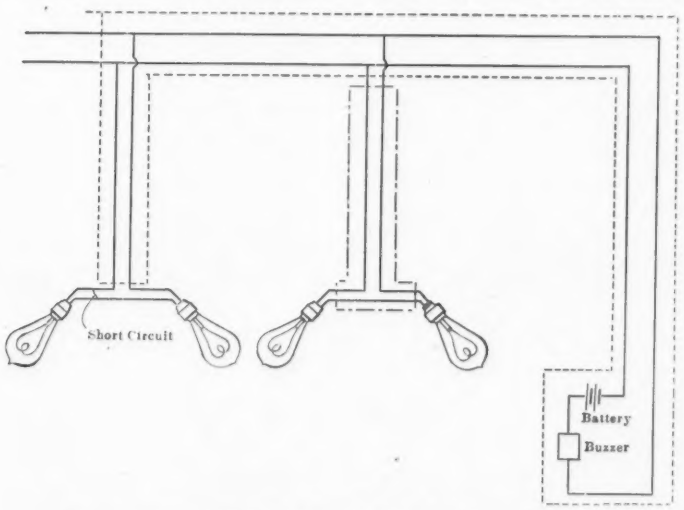


FIG. 3.—LOCATION OF SHORT-CIRCUIT BY INSTRUMENT.

whereas the dash-and-dot lines show that part of the circuit which is silent. In Fig. 3 a battery is placed in series with the buzzer, the dotted lines showing the circuit in which the sound was heard and the dash-and-dot lines showing the circuit in which no sound was heard. The positions of the short are indicated in both instances. Where there are a number of shorts on the same line, the nearest short is indicated first. After removing this, if the buzzer still vibrates, the next short is located in like manner, and so on until the line is cleared. A coil of this kind may also be used to locate concealed pipe in buildings or pipe underground. The direction of the run is indicated as well as all branch lines. When used in such work about one-quarter pound more of wire should be added and five batteries should be used. Useless tearing up of floors and partitions and useless digging may thus be avoided in locating pipe runs.

WASHINGTON, D. C. C. W. PETRY.

I have read with no little interest W. Kavanagh's method of reversing the polarity of a generator as published in the first issue of the ELECTRICAL WORLD, and while the method given is ingenious, a less ostentatious method is available in which the reversal of polarity is accomplished by means of the series coils. The equalizer and circuit switches on the machine are all single pole and a switch with a discharge resistance is provided for the shunt-field circuit. Suppose one machine to be in service and the reversed machine to be disconnected from the bus bars; but running at full speed. The shunt-field switch of the reversed machine must be opened after which the equalizer switch of the reversed machine may be closed together with the main-circuit switch controlling the series coils. Current from the machine in service will then be shunted through the series coils of the reversed machine and this will usually be sufficient to reverse whatever residual magnetism remains in this latter machine. This fact will be indicated on the voltmeter, which will show a small voltage in the right direction. The shunt-field circuit may then be switched in and the machine should at once begin to build up. When the working voltage is reached the other main switch may be thrown in and the generator given its share of the load. If the amount of current shunted through the series coils of the defective machine is insufficient to reverse the residual magnetism, the series circuit of the machine in service may be opened and the whole current from the machine forced through the series coils of the reversed machine, and under working conditions this will not fail to cause this generator to

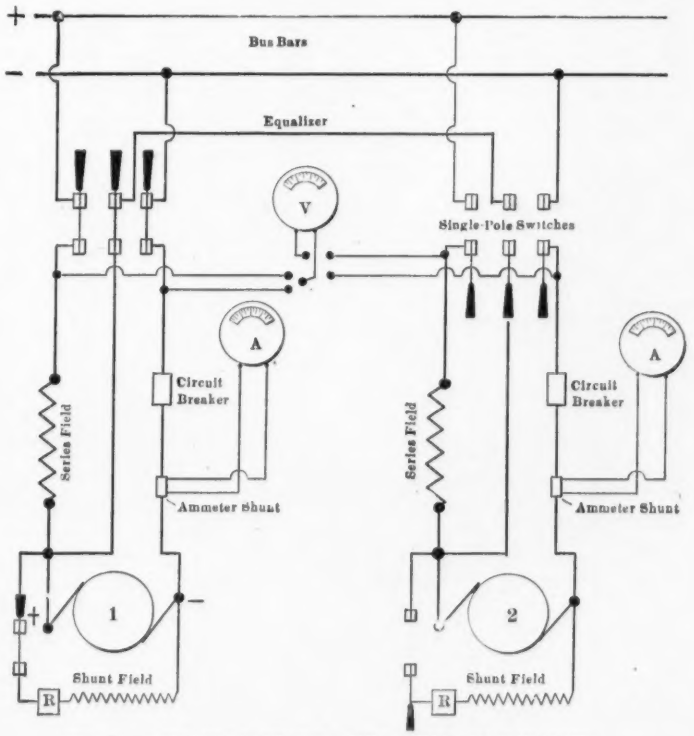


FIG. 1.—COMPOUND-WOUND GENERATORS IN PARALLEL.

build up properly. With the generators equipped as described the process of re-reversing the polarity of a generator and giving the machine its load requires no more time than that consumed in usually building up the machine and connecting it to the bus bars. Where the generator is not provided with a shunt-field switch and a discharge resistance, it is best to stop the machine and effect an opening in the shunt-field circuit by insulating the brush of the rheostat from the contact posts. Where the gen-

erator is supplied with a three-pole switch, the lead containing the circuit breaker and ammeter may be temporarily disconnected by simply tripping the circuit breaker when throwing the series-field coils in parallel.

Brooklyn, N. Y. C. Thomas Jones.

A dynamo which has had its polarity reversed may be re-reversed much more simply and quickly than one would be led to suppose from Mr. Kavanagh's leter, published in the January 6 issue. Where there is but a single generator in a station the case is, of course, most troublesome, especially if the station is remote from all sources of current. In Mr. Kavanagh's case one machine was at rest and the other machine was running, the machine at rest having its polarity reversed. To re-reverse the polarity of this machine one of the armature terminals of the dead machine should be disconnected, and while the circuit through the machine's armature is thus opened, its circuit breaker and switches should be closed just as if it were going into service. Current from the bus bars will then excite the field in the right direction. Upon opening the switches and restoring the armature connection, the dynamo may be started up and put in circuit with its mate. Special care must be taken, however, to make sure that the armature circuit of the reversed machine is open before closing the circuit breaker and switches to magnetize it properly and that either the main switch or the circuit breaker is again opened before the armature terminal is

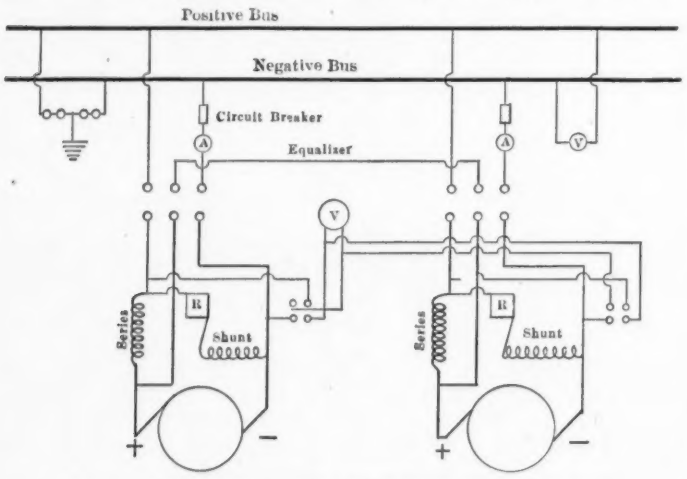


FIG. 2.—COMPOUND-WOUND GENERATORS IN PARALLEL.

restored to place. Failure to observe these precautions will result in a short circuit.

New York City. J. Van Dyke.

A somewhat similar suggestion has been received from G. A. Iler, Thomas, W. Va.

MR. WHITE'S PROBLEMS IN LAMP AND INSTRUMENT WIRING.

I submit the accompanying diagram, Fig. 1, as a solution to Mr. White's problem in lamp wiring. Forty-eight lamps are connected on one side of the circuit and thirty-two on the other. One triple-pole double-throw switch suffices to solve the problem and by reference to the diagram it will be seen that it is impossible to throw 220-volt current either through the 110-volt lamps or back into the transformer. When the switch is thrown to the right the lamps are placed in multiple across the 110-volt mains. Throwing the switch to the left places the banks of lamps in series across the 220-volt mains. If it is desired to cut out either circuit at any time three-pole single-throw switches may be installed in each branch. Fig. 2 gives a solution to Mr. White's problem in instrument connections. The ammeter is connected to the hinges of a double-pole double-throw switch as indicated and single-pole single-throw switches are connected across the exciter-circuit leads. It is evident from the connections that the circuit may be kept closed while changing the ammeter from one circuit to the other. In operation the ammeter is first thrown on the exciter circuit and the single-pole switch across that circuit then opened. After the reading is taken the single-pole switch is closed and then the ammeter disconnected from that circuit. The same sequence of operation obtains on the other exciter circuit.

York, Pa. J. Henry Peck.

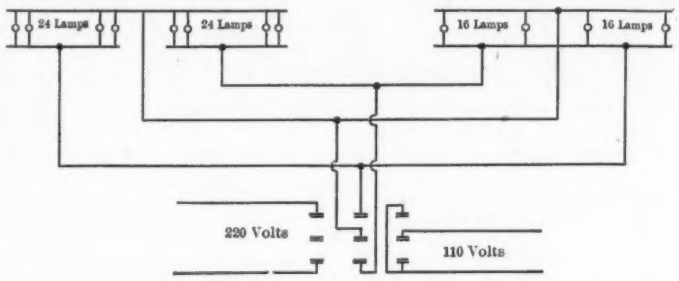


FIG. 1.—MR. PECK'S SOLUTION TO MR. WHITE'S PROBLEM IN LAMP CONNECTIONS.

These solutions coincide with those submitted by Mr. White. Similar solutions were received from J. Lindsay, New York; P. Mack, Omaha, Neb.; J. Redmond, Philadelphia, Pa.; H. Rush, Seattle, Wash.; Kenneth Spencer, Richmond, Va., and H. Silvester, Detroit, Mich.

The following solution (Fig. 3) is intended for Mr. White's exciter ammeter problem published in the January 6 issue. Two

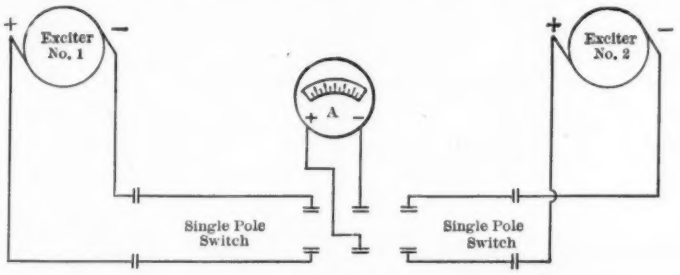


FIG. 2.—MR. PECK'S SOLUTION TO PROBLEM IN INSTRUMENT CONNECTION.

single-pole single-throw switches are connected across one lead from the exciter and the negative bus bar as shown, and a two-point switch or a single-pole double-throw switch is used to throw the ammeter in circuit with either exciter. To obtain a reading from the exciter circuit on the left, the two-point switch is thrown over to contact 2 and the single-pole switch on that side of the circuit opened. To obtain a reading from the circuit on the right, the single-pole switch in the circuit on the left is closed, the two-point switch is thrown over to contact 3 and the single-pole switch on the right is opened.

Victor, Col. D. C. McMeehan.

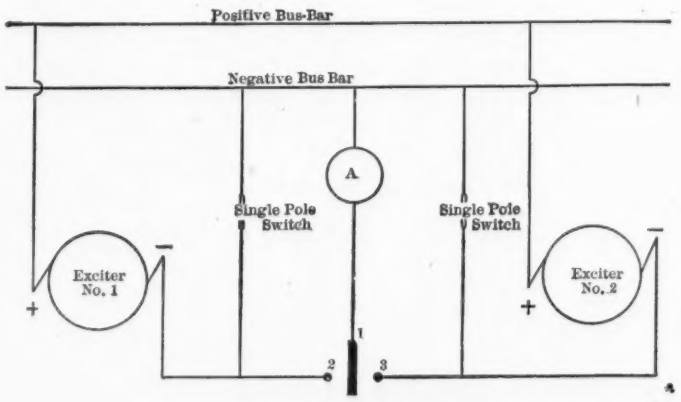


FIG. 3.—MR. M'MEEHAN'S SOLUTION.

I noticed Mr. White's problem in instrument connections in the January 6 issue, and having had the same problem to solve some time ago, the method used may be of interest. Fig. 4 shows a rather rough sketch of the apparatus made for the purpose. Two wedge-shaped pieces of well-seasoned wood boiled

in paraffin are fitted with clips of spring brass, as shown. These clips are normally in contact with each other at their outer ends as indicated, and each clip is connected to one lead of the exciter circuit. Pivoted between the posts and free to swing, is a handle of wood treated with paraffin. One side is fitted with a

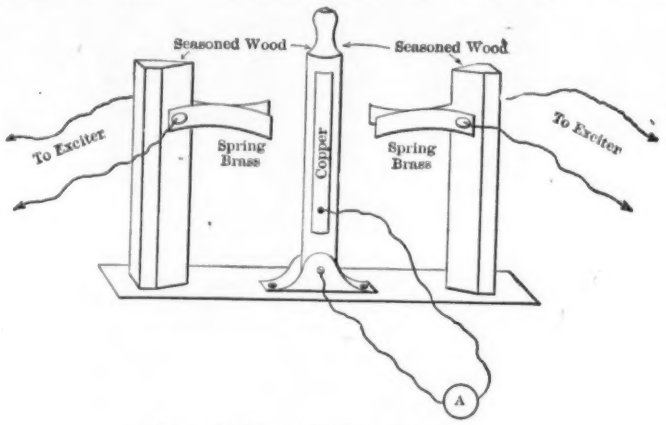


FIG. 4.—MR. ADDAMS' SOLUTION.

piece of copper which wipes against a contact near the base, and the other side is fitted with a piece of copper its entire length, the pin on which the handle swings passes through the copper strip also, thereby making electrical connection with it. The ammeter is connected to these insulated strips. When a reading is desired, say of the exciter on the right, the handle is swung to that side; the spring brass clips are separated and the ammeter is placed in circuit. Current then flows from the exciter to the clip on the far side of the post, down the copper strip on that side of the handle to the pivot at the base, through the ammeter and back to the copper strip on the near side of the handle to the clip and out to the exciter circuit again. As soon as the handle is swung to the other side the brass clips snap together again so that the circuit is not broken. The sketch shows the apparatus bottom-side up, the handle being normally out of circuit, and occupying a mid position where it is retained by gravity. The apparatus works well for small exciter currents and was found very convenient for other purposes as well.

NEWBURGH, N. Y. M. S. ADDAMS.

MR. BLACK'S PROBLEM IN MOTOR WIRING.

I submit the accompanying diagram as a solution of Mr. R. O. Black's problem in motor wiring, published in the January 6 issue of the ELECTRICAL WORLD. Two series motors are connected to a line shaft and it is required to give the simplest arrangement of switches to obtain the following results: One motor only in circuit; two motors in series; two motors in parallel; two fields in parallel, armatures in series; two armatures in parallel, fields in series. In my solution I have endeavored to make the switchboard as nearly symmetrical as possible so as to avoid the confusion of having a large number of switches irregularly placed. Besides the double-pole single-throw switch which controls the current from the mains, five double-pole double-throw switches and two triple-pole single-pole switches are employed. By reference to the diagram it will be seen that switch No. 1 disconnects the whole system, including the controller, from the mains. When switches No. 1 and No. 2 are closed, the latter downward, either motor may be placed in circuit by simply closing its respective three-pole switch and closing switch No. 5 downward. By closing both three-pole switches with switch No. 5 still closed downward, both machines will be thrown in parallel. The motors may be placed in series by leaving switches No. 3 and No. 4 closed and throwing switch No. 5 upward. When it is desired to place both fields in parallel and the armatures in series, switches No. 3 and No. 4 are opened, switch No. 2 closed upward and switches No. 6 and No. 7 are closed downward. To place the two armatures in parallel and the fields in series, switch No. 2 is still closed upward, and switches No. 6 and No. 7 are also closed upward. By tracing the connections it will be seen that the current always enters the armatures and fields in the same direction, so that there is no danger of reversal on changing connections. It will also be evident that when switch No. 2 is closed upward, switches No. 6 and No. 7 are the working switches and switches No. 3 and No. 4 must be kept open. Likewise when switch No. 2 is closed downward switches No. 3, No. 4 and No. 5 are the working switches, and switches No. 6 and No. 7 must be kept open. The

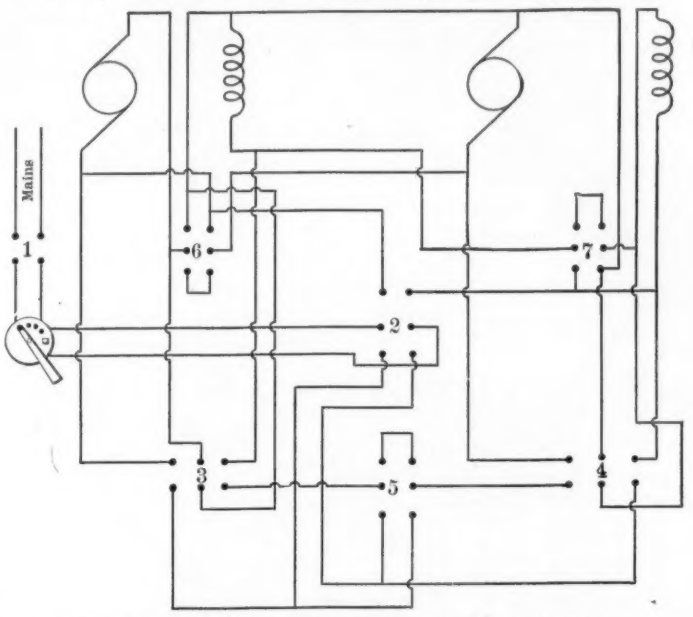


FIG. 1.—MR. EVANS' SOLUTION TO MR. BLACK'S PROBLEM.

direction in which switch No. 2 is closed always indicates whether the top or bottom switches are to be used. It will also be evident that switches No. 6 and No. 7 are always closed in the same direction; either both up or both down. The scheme is not fool-proof because a short circuit would occur if either switch No. 3 or No. 4 were closed while switches No. 6 and No. 7 were working and vice versa. As a precaution, therefore, the controller should be provided with an automatic circuit-breaker or overload release.

EATON, IND. CHESTER A. EVANS.

I beg to suggest the following solution of Mr. R. A. Black's series motor wiring problem in the ELECTRICAL WORLD of January 6. A special knife-switch arrangement is used, built up from

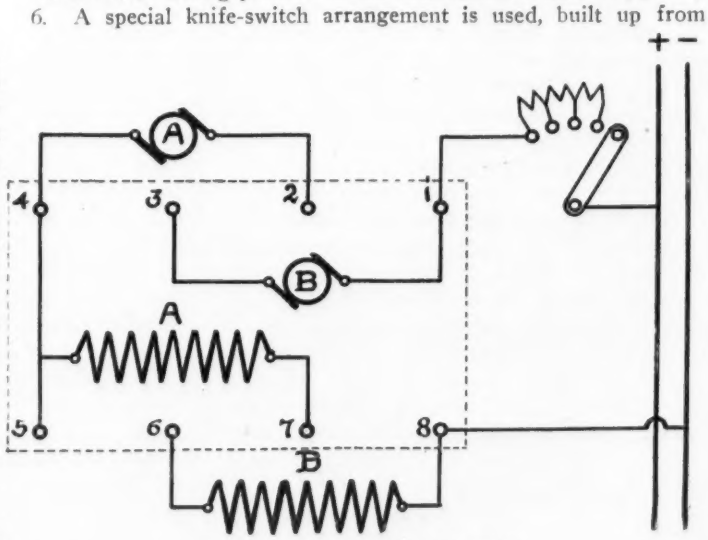


FIG. 2.—MR. MEURER'S SOLUTION.

standard parts and consisting of four hinge posts with blades and four other posts. In the accompanying illustration the hinges are at points 1, 3, 6 and 8. To obtain the desired results the following connections must be made by the knife blades: Motor A alone, 1-2, 7-8; motor B alone, 3-4, 5-6; motors in series, 2-3, 6-7; motors in parallel, 1-2, 3-4, 5-6, 7-8; armatures in parallel, fields in series, 1-2, 3-4, 6-7; armatures in series, fields in parallel, 2-3, 5-6, 7-8. Care must be taken in choosing the knife switch that the handle clears the posts in the switch positions 1-2, 2-3, 6-7 and 7-8.

YONKERS, N. Y. FRED MEURER.

IMPROVEMENTS IN APPLIANCES AND APPARATUS.

Alternating-Current Motor Reverser.—A simple non-sparking, quick-acting means of reversing alternating-current motors instantly was recently patented by E. H. Porter and B. Currier. It is well known that any alternating-current motor can be reversed in rotation by reversing the relative direction of the current in any one of its independent energizing circuits. In the circuit to be reversed two alternating e.m.f's, or currents of opposing phase relation in series whose algebraic sum is zero, are supplied. By weakening either of the e.m.f's, or short-circuiting it entirely, the other e.m.f. is left to partly or fully supply the current in the desired direction. One application is shown in

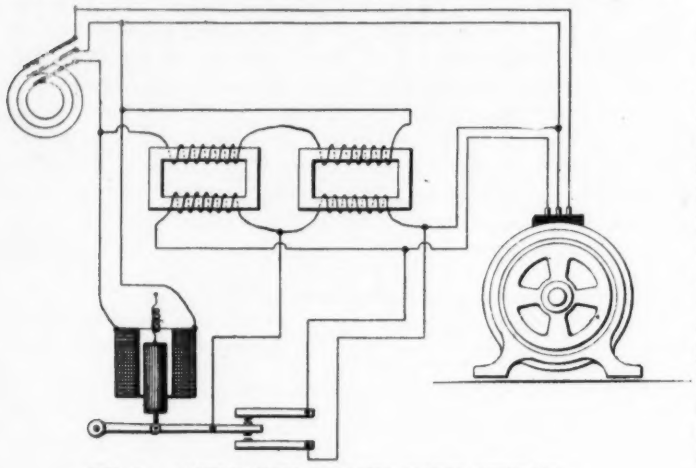


FIG. 1.—ALTERNATING-CURRENT MOTOR REVERSER.

Fig. 1, which is a diagrammatic view showing an induction motor with reversing transformers, short-circuiting contacts and regulating solenoid with core in conjunction with an alternating-current source of supply. It is evident that when the upper contact connected with the secondary and the other secondary contact connected to the solenoid are brought together, the secondary winding of the transformer on the left is short-circuited, thereby neutralizing the impedance of the primary of this transformer and applying the full e.m.f. to the primary of the other transformer and hence to the secondary, thereby energizing the circuit in a given direction. An opposite result is obtained when the transformer at the right is short-circuited in the manner described. The movements of the contacts are controlled by the solenoid.

The "Clipper" Belt Fastener.—*Engineering*, of London, describes a method of jointing belts which appears to have decided advantages over many other means of obtaining the same result. The old way of lacing the ends of belts together is unsatisfactory for many reasons, and most of the patent fasteners on the market project from the back of the belt in such a way as to prevent the back surface from working over the pulley. In the method illustrated herewith both sides of the belt are the same and the joint is very flexible. The wire hooks have one side shorter than the

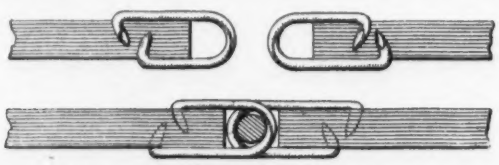


FIG. 2.—THE "CLIPPER" BELT FASTENER.

other, and a series of them is placed in grooves formed in a brass anvil used in making the joints; the long and the short sides of the pins alternating. The two ends of the belt being equipped with a row of the hooks, a hinge pin of raw hide is drawn through the joint as shown in the lower illustration. It is stated that belts may be rapidly jointed by this method and the fastening is cheap, flexible and very strong.

Fuse Plug.—Fig. 3 is a sectional elevation of an improved fuse plug recently patented by H. T. Paiste. A metallic shell, open at one end and closed at the opposite end by a head of por-

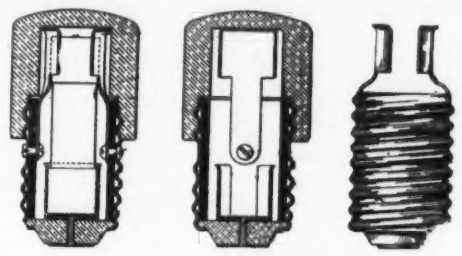


FIG. 3.—FUSE PLUG.

celain or other insulating material, is provided with an insulating lining. A pair of spring clips, having adjacent faces concave, is electrically connected to a small plate on the top of the plug. A second pair of metallic spring clips which project beyond the open end of the shell are electrically connected with the threaded shell by means of small bolts or rivets. It will be seen that one pair of spring clips engages one of the metallic ends of the ordinary enclosed fuse, while the second pair projecting outside of the threaded shell receives the other end of the fuse case. The porcelain cap is threaded so that it may be screwed over the end of the fuse plug, which has the outwardly projecting clips, the opposite end of the plug being adapted to be screwed into a cut-out. By means of this construction a fuse may be conveniently removed from the plug without the necessity of unscrewing the latter from the cut-out block in which it is used. The condition of the fuse can also be ascertained, since with cartridge fuses of the ordinary construction the indicator opening will be in plain view when the fuse case is in operative position. A modification is shown at the right of the engraving.

Oil and Water Separator.—Many devices have been introduced at various times for the purpose of separating water or oil suspended in minute form and carried along in currents of steam, as either of these fluids is generally objectionable. Another design added to the list is described in *The Mechanical Engineer*, of London. The general construction will be perceived from the illustrations herewith. Two concentric cylindrical rows of angular strips of metal with slight vertical spaces between

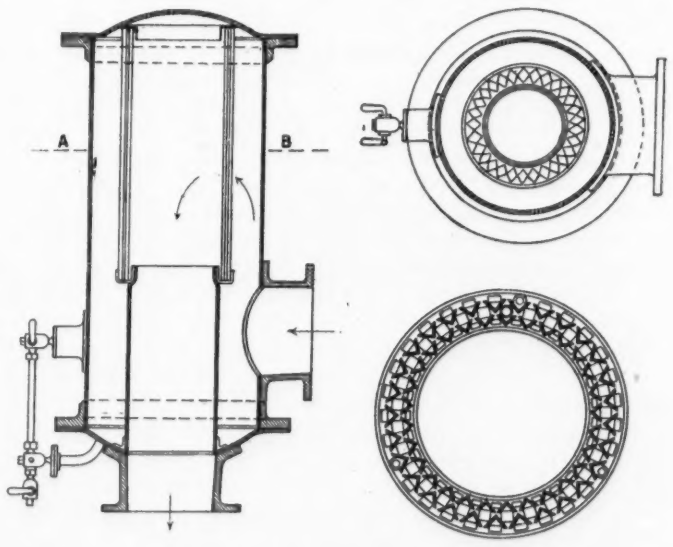


FIG. 4.—OIL AND WATER SEPARATOR.

them are arranged so that the strips break joint. In this manner the inner row intercepts any suspended matter passing between the interspaces of the outer one. By this means an extensive contact surface is secured, a detail which is an important part in separation, because the water or oil must adhere to it until it drains into the well in the base, which is fitted with the usual gauge glass and blow-off arrangement.

Detachable Electrical Connection.—With the purpose in view of providing an electric plug which could be easily inserted in or removed from a socket, A. N. Lawrence, Jr., has patented the device shown in Fig. 5. The plug is provided with a recessed lower face containing the binding post nuts for securing the conductors, while the outer side of the plug is formed with recesses adapted to contain spring contact fingers which are connected to one terminal as indicated. The plug may be shoved directly into the socket to its seating position, the spring contact fingers retiring into their recesses when passing over the projections of the threaded shell and springing out again into contact with the grooves when the plug is seated.

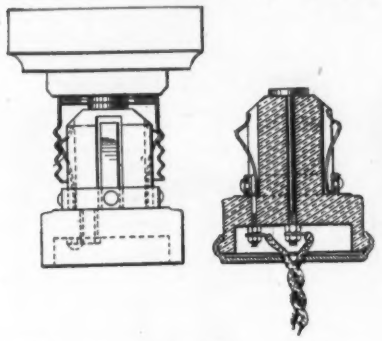
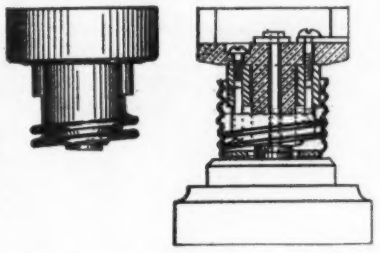


FIG. 5.—DETACHABLE ELECTRICAL CONNECTION.



FIGS. 6 AND 7.—DETACHABLE ELECTRICAL CONNECTION.

Another device of the same general character, patented by Mr. Lawrence is shown in Fig. 6. The plug has a portion which is smaller in diameter than the internal diameter of the socket, and projecting from the outer surface of this portion is a spring forming one terminal of the plug. This spring is compressed toward the surface of the plug when the latter is inserted and as soon as the plug is seated engages the threads and holds the plug in place, at the same time forming a good electrical connection between the plug and socket. A side elevation of the plug is shown in Fig. 7.

Push-Button Switch.—The *Electrical Engineer*, of London, publishes the particulars of the push-button switch, shown by Fig. 8, herewith. In this switch the "on" and "off" positions are obtained by alternate movements of the button which turns

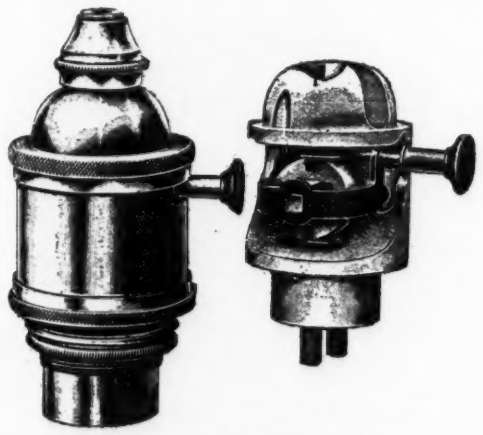


FIG. 8.—PUSH-BUTTON SWITCH.

a small ratchet on its axis. Across the diameter of this ratchet is fixed the bridging piece which closes the switch. The porcelain holder is made in two pieces, and the terminals are so arranged that for wiring it is only necessary to remove the top ring and nipple without withdrawing the porcelain from the body.

Fire-Proof Wire.—In order to provide in a single article an armor conduit containing an insulated fire-proof, weather-proof conductor capable of internal and eternal use in all the positions which have heretofore required the usual lead or iron pipes, in which the specially prepared wires have been fished or inserted, Amanda M. Lougee has patented the fire-proof wire shown by Fig. 9, herewith. By reference to the illustration, it will be seen that the wire is covered with a rubber compound, then a protecting fabric, followed by a fire-proof jacket, rubber cement, wire armor and fire-proof compound in the order named. The wire armor is of the closely woven kind, which is capable of repeated bending without injury and may also be woven very tightly in place.

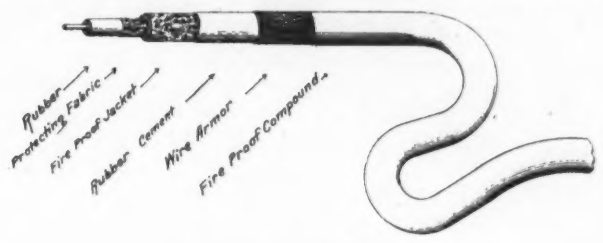


FIG. 9.—FIRE-PROOF WIRE.

Apparatus for Controlling the Feed Water Supply to Boilers.—The accompanying illustration, taken from the *Mechanical Engineer*, of London, shows an arrangement for controlling the supply of feed water to boilers in a simple and effective manner. A piston, *A*, is formed integrally with a check valve, *B*, corresponding to the usual check valve situated on the feed pipe to the boiler. Water from the pump passes to the check valve by way of the passage, *C*, and when the valve is lifted passes to the boiler by the pipe, *D*. The piston is an easy fit within the cylinder connected to the check valve casing, and the whole arrangement is situated outside the boiler. The space above the piston is connected to the boiler by a pipe entering the normal steam space of the boiler. This pipe is, however, so situated that when the water in the boiler rises unduly high, it can pass through the pipe to the space above the piston. Therefore when water is pumped into the boiler, and the check valve rises and falls during the pumping action, the piston has to displace the water above it before it can rise. The piston is forced, therefore, to act sluggishly and the check valve is prevented from opening wide, thereby limiting the supply to the boiler. By means of a valve on the pipe joining the cylinder with the boiler, the retarding action of the water on the movement of the check valve can be regulated.

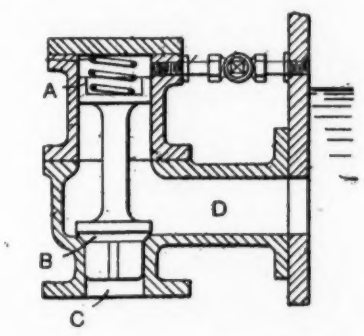


FIG. 10.—FEED-WATER CONTROLLER.

Indicating Fuse.—C. W. Rhoades has patented the indicating fuse shown in section by Fig. 11. The improvement consists in providing the fuse with means for indicating its condition immediately upon blowing. A hinged spring indicator is held against the surface of the fuse casing by means of a thread or wire which passes around the enclosed fuse, as shown. When the fuse blows the thread is released and the hinged spring indicator flies upwards.

FIG. 11.—INDICATING SAFETY FUSE.

E. L. Ogle has patented improvements in enclosed fuses, which consist in providing the fuse with means for indicating its condition merely by visual inspection and for protecting the heat-affected medium. The tally fuse is exposed on the outside of the shell or laid in a suitable recess and covered with a layer of chemically treated paper, which becomes discolored by heat. This

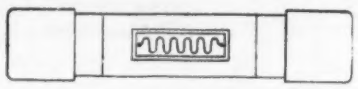


FIG. 12.—INDICATING FUSE.

paper is covered by a sheet of mica, so that when the fuse blows there will be no danger of fire.

Blow-Off Valve.—Fig. 13 herewith shows a recently designed blow-off valve, which combines in one casing a rotary valve and a rotary hollow plug or shell in such a manner that both valves are operated by a common spindle, one valve, however, being opened before the other and closed after it. This valve is described in *The Mechanical Engineer,* of London. A rotary disc *A* furnished with an opening *B* works on a seat *C* having a similar opening *D,* which is opened and closed by turning the disc, the opening movement being governed by a stop *F* on the spindle and a corresponding stop *G* on the cover of the valve casing. In combination with the disc and turned by it is a hollow plug *H* working in a seat in the casing and provided with an opening in the wall, which when brought into agreement with the opening *S* in the casing forms the outlet. The construction and arrangement are such that when the spindle is turned for the purpose of opening the valve the outlet in the plug opens first and is fully opened before the outlet through the disc valve begins to open, and conversely when closing the valve the outlet in the plug remains open until the outlet in the disc valve is fully closed; so that the plug is neither being opened nor being closed while there is a flow through the casing. The faces of the plug and seat, upon which dependence is based for securing tightness, are therefore not subjected to the passing currents when blowing through. The mechanism is so designed that as soon as the plug

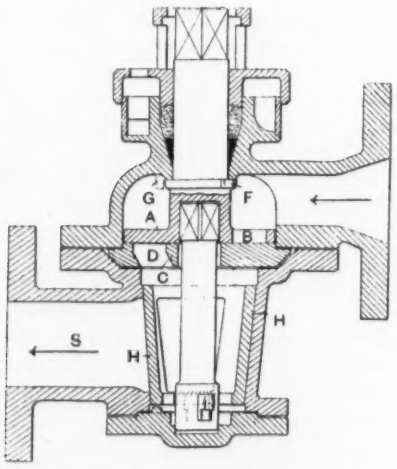
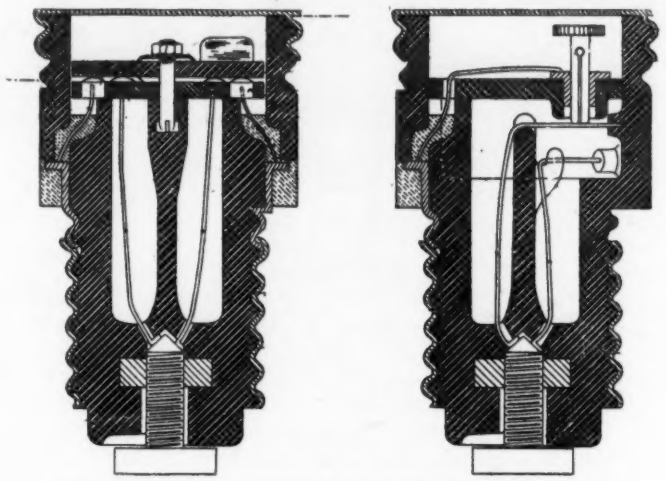


FIG. 13.—BLOW-OFF VALVE.

is fully opened it remains stationary in that position until the disc valve completes its opening movement, and also remains stationary while the disc valve is closing. The advantage of this arrangement is that the backing and edges of the openings of the plug or cock, or of its seat, are at no time subjected to the scouring action of fluid.

Switch Plug with Electrical Fuse.—Alexander Hepke and Kurt Diener have jointly invented the fused switch plug shown by Fig. 14 herewith. Two fuse wires are provided within the plug body and are connected to the contact screw shown at the bottom of the illustration. The upper ends of the fuse wires terminate in two contact pieces which are situated in a disc of insulating material. In this same disc are also fixed two other contact pieces which by means of wires are connected to the screw-threaded metal shell forming the contact with the plug socket. Above the disc is a second disc of insulating material, which is provided with a metal plate so constructed as to form an electrical connection between one of the two contact pairs.



FIGS. 14 AND 15.—SWITCH PLUG WITH SEVERAL FUSES.

When the plug is inserted in the socket the current flows from the lower contact screw through the fuse to a contact, to the metal plate on the upper disc, through the other contact to the shell. When the fuse blows the upper disc is turned by means of a handle so that the metal piece on the bottom of this disc comes in contact with the second contact pair. A modification is shown in Fig. 15, where, if the upper fuse blows, the plug is pushed downward so as to engage the under fuse.

Crane Motor with Electric Safety Brake.—The *Electrician,* of London, describes a crane motor with electric safety brake built by Dick, Kerr & Co., a view showing this latter attachment being given in Fig. 16. This brake is formed in an extension of the commutator bearing, an annular space being provided in which is carried an exciting coil, *E.* On the extended hub is carried a conical cast-steel ring, *R,* which is free to move laterally. In this ring, steel springs are carried, which normally tend to push the ring away from the face of the magnet. At the extreme end of the motor shaft a malleable iron crown, *C,* is keyed. When the motor is disconnected from the power circuit, the spiral springs thrust the conical steel ring into the crown. If current is switched on the electromagnet becomes energized, and the action overcoming the thrust of the springs, the ring is attracted to the face of the magnet, which leaves the crown, and consequently the shaft free to revolve.

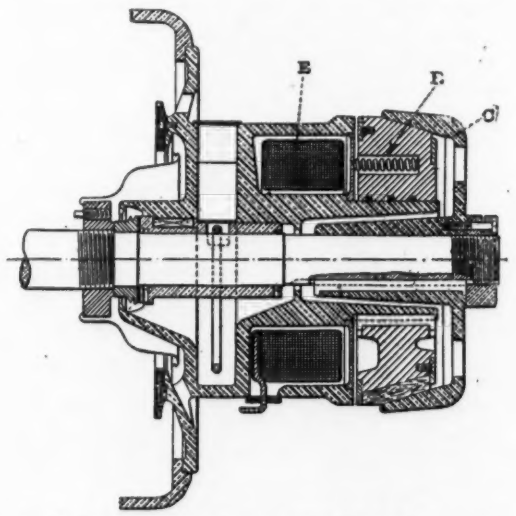


FIG. 16.—ELECTRIC SAFETY BRAKE FOR CRANE MOTOR.

QUESTIONS AND ANSWERS.

We have a 65-kw alternator having 12 poles, 12 armature coils and a speed of 1,400 r.p.m. For special reasons we want to reduce the speed to 700 r.p.m. and place 24 coils in the armature, doubling the number of armature turns. Can we do this and obtain good results? W. J. W.

You may reduce the speed by this means and obtain the same voltage as before, but the machine would deliver only one-half of the former current. The frequency would also be halved.

Can you give me a cheap and practical way of producing a dull black finish on copper, such as is used on switchboard instruments? A. E. B.

Dip the copper in a solution consisting of carbonate of copper dissolved in ammonia, and allow the copper to remain in the solution until the desired tint is obtained. Another solution which is very widely used consists of ¼ lb. verdigris, ¼ lb. sal soda, ¼ lb. carbonate of ammonia and 3 pints of water.

I have a compound-wound motor operating on a 220-volt circuit which takes 6 amperes when starting, and not being able to use a starting resistance there naturally is much sparking. Can I use a condenser in some way to lessen this arcing? F. G. F.

A condenser will have no effect whatever in lessening the arc at the brushes of your motor. We know of no means of lessening this arc except possibly by connecting an inductance coil in series with the motor.

Please give me the dimensions for a spark coil large enough to operate wireless telegraphy outfit for a distance of one mile overland. B. T. H.

At least a 6-inch spark coil should be used. A coil of this size may have the following dimensions: Length of core, 12 in.; diameter of core, 1⅛ in.; primary coil should have two layers of No. 12 B. & S. copper wire, the secondary coil should be made up of 7 pounds of No. 36 B. & S. copper wire; the core should be made of No. 22 B.W.G. soft iron wire; the condenser for the coil should have 60 sheets of tin-foil, each 10 in. x 5 in.

What effect will a decrease in the line voltage have on the amount of current taken by a shunt-wound motor and by a series-wound motor? R. G.

A decrease in the e.m.f. impressed on the motor terminals of either a shunt-wound or series-wound motor, causes a decrease in speed; and with an ordinary load, if the speed at which the load is driven be lessened, the power delivered by the motor is lessened, and, therefore, the watts needed by the motor reduced in value. Whether the current has been decreased or not depends on the relative changes in the value of the power delivered and the terminal voltage.

Why should a coil on a armature burn out when the two commutator segments to which the coil is connected are short-circuited? E. B. J.

The coil, segments and the short-circuit between the segments form a complete circuit having a low resistance. The sides of the coil which are on the armature cut across the magnetic lines of the pole-pieces and have e.m.f.'s set up in them. Since the resistance of this closed circuit is very low, it is only necessary to have a low e.m.f. set up in the active portion of the coil in order to force a very large current through the coil and the two short-circuited commutator bars. The heating action of this large current is usually sufficient to burn out the coil.

How may I cut out a damaged coil from an armature? K. K. R.

Disconnect the damaged coil from the commutator and after cutting off the leads insulate the exposed parts with tape. Then connect the bars to which the leads of the damaged coil were connected with a wire, or jumper, as it is commonly called, of the same size as that used in the winding. To remove the coil entirely it will be necessary to cut the band wires or remove the wedges, and raise a sufficient number of leads and coils to permit the removal of the defective coil; after which a new coil may be put in place.

I recently read an account in a daily paper to the effect that a wireless telegraph system may be used to locate precious metals. Is this practicable, or is it merely a daily newspaper yarn? E. K. W.

We doubt the accuracy of the statement. The ohmmeter has been used with success in mining operations by measuring the resistance between two stakes driven well in the ground. A metaliferous vein would of course have a low resistance as compared with the resistance of dry earth, and its direction could be fairly well located by this means. Whether the vein contained precious metal or merely titaniferous iron ore could only be ascertained by the laborious and primitive process of digging.

We are running a motor-generator set, the brushes of which give considerable trouble. The copper brushes cut the commutator on one side and reversing the brushes gives no remedy, the outside brush cutting despite all we can do. On another machine the carbon brushes are so noisy in operation that one can hardly hear oneself speak. How may this be remedied? R. F. T.

Since reversing the brushes does not remedy your trouble, it is evident that the fault is in the brush holder and not in the brush. The noise of carbon brushes may be lessened to a great extent by sandpapering the brushes to fit the commutator better and by occasionally lubricating the commutator with a little vaseline.

Kindly inform me as to the principle of operation of the Tirrill regulator. J. C.

The automatic potential regulator devised by A. A. Tirrill rapidly opens and closes a shunt across the generator field rheostat. The regulator has a main control magnet and relay; the former taking power from the bus-bars or from potential wires brought back from the center of distribution, and operating the main contacts. By means of a spring, the magnets are arranged just to open and close these contacts at the desired voltage. By this means one of the differential windings of a relay is opened and closed, thus causing a simultaneous opening and closing of the relay contacts which throws in and out the field rheostat.

A mine haulage plant furnishes current at 270 volts, which is transmitted one mile. Half of the time the load equals 900 amperes and at other times 100 amperes. When using the maximum current the drop is too heavy to give us good service. Would it be better to change the service to alternating current and use rotaries to convert the current at the place of consumption, or float storage batteries on the present system to act as a sort of booster? R. M. E.

The question resolves itself to one of cost. To scrape the direct-current equipment and install an alternator and rotary converter may or may not be advisable; but the addition of a storage battery large enough to take the entire load in case of mishap to the main plant also presents disadvantages. Generally a mixed service should be avoided unless the saving in cost of operation more than justifies it. You will probably find it cheaper and more convenient to use a storage battery.

(1) Recently in unwinding an induction coil, I noticed that the white cotton insulation had become green. Is this due to chemical action between the copper and the shellac, or between the cotton and the shellac? (2) Would this affect the insulating property of the cotton? P. C. P.

A green coil is an evidence of bad construction; that is, so far as the insulation is concerned. Ordinary shellac is composed of from 14 to 17 separate and distinct acids, any one of which acting on the copper would product the result mentioned. In fact when very fine wire is used in a coil and saturated with shellac it is not uncommon to find the copper eaten across. Needless to say, the insulating qualities of the cotton are very greatly impaired, and it would be better to rewind the coil using a paraffin compound having a high melting point instead of shellac.

In wiring a factory supplied with alternating current with insulated galvanized-iron wire would any induction be present? G. A. W.

Two parallel wires carrying alternating current induce in each other inductive e.m.f's which tend to retard the flow of current, and the closer together the wires are, the less is this effect. In the case of an iron wire circuit the effect is about 150 times greater than in a circuit of copper wire. For copper wire the inductance of each wire in millihenrys per foot is equal to $.00001524 + .00014\ log\ (d \div r)$. For iron wire the inductance in millihenrys for each foot of wire is equal to $.002286 + .00014\ log\ (d \div r)$; d being the distance apart from center to center of the wires, and r the radius of the wires.

What is the proper size of transformer for the following systems, assuming 100 kilowatts to be the load upon the circuit? Each transformer on a three-phase, three-wire system; each transformer on a three-phase, four-wire system; each transformer on a three-phase system with the Scott method of transformation from three to two-phase? E. J. Y.

The proper size of transformers would be as follows: Each transformer on a three-phase, three-wire system, 33⅓ kw; each transformer on a three-phase, four-wire system, 33⅓ kw; transformers on a three-phase system employing the Scott method of transformation from three to two-phase, one 50 kw and the other 1/7 larger. It will be necessary for you to choose standard transformers having capacities which are nearly proportional to the above.

Organization and Development of a New Business Department.

At the recent meeting of the Northwestern Electrical Association a paper by Mr. George Williams on the above subject led to a lengthy discussion. In his paper Mr. Williams said that the necessity for a new business department exists in every central station company. The tendency in the past to look upon this department as an extravagance has, he considers, been due to the lack of proper organization and appreciation of its functions. He pointed out the great opportunities for central station business that exist everywhere. Every central station manager has at his very door revenue that can be secured without increase of installation if he only knows how to get it; and his success in getting it will depend upon organized effort. Mr. Williams dwelt upon the necessity of business courtesy, dispatch in trouble cases, knowledge of what one has to sell, its cost and its possibilities. He pointed out the value of midnight and all-night illumination of stores, windows, signs and building cornices. For example, the installation of 100 lamps in residences will not earn the equivalent of a small sign of 10 or 15 lamps. He advocated the use of electric signs by the central station company to advertise itself, with illumination until midnight and in large cities all night.

President-elect Harold Almert, in the discussion of Mr. Williams' paper, outlined a plan of campaign suitable for a small or medium-sized company for getting business. Mr. Almert was emphatically in favor of central station men getting out and advertising their wares, instead, as was too often the case in the past, of being satisfied with what business comes to them unsolicited. "You have," he said, "got to display and advertise your wares, solicit and keep everlastingly after new business, or be numbered among the dead ones in very short order." This branch of central station business instead of improving, he said, seemed to be getting worse with the result that the manufacturers find they are now obliged to take a hand in self-defense.

In setting forth the plan for smaller central stations, he said the first requisite was to maintain an attractive office, and at all times an attractive window display which should be changed frequently, and invitations extended for people to come to the office. A map should be prepared on a suitable scale on which to mark approximately the correct location of every building in town, laying out on the map the distributing system by means of cord of different colors, designating primaries, secondaries, etc. A canvass should then be made by sections and streets of every house in the town, and a user or non-user of electric lights designated on the map by pins with heads of different colors. Information in full detail should also be recorded on cards, including the name, address, location, whether house, flat or store, etc., kind of illumination, whether house is wired or not, whether equipped with fixtures, distance from lines, etc. The four elements of a sale are, first, the introduction, either by letter or personal interview; second, creating a desire for what one is to sell; third, selecting and adjusting what one is to sell to the particular need of the prospective customer and working up the point where he would be ready to sign; fourth, the sale. The first can be cared for by a carefully drawn form letter, general in character; the second by more form letters giving more details and by a personal interview; the third by another personal interview, reviewing what has gone before, adding desirable features and cutting out objectionable ones.

To a prospective customer should be sent the first form letter and at the same time the date stamped in the proper column of a form printed on the back of the subject's card. At the same time a marker should be placed in the file in front of the card having on it the date when the case should again be given attention. Assuming that the date stamped is the 17th, the card marker will then be for, say, the 21st, and when this date arrives, in looking down the file the markers will be so placed that all cards requiring attention on the 21st will be in line. The card is taken out on the 21st and the notation on the back will then show the next move in the matter. If a personal call should be made, the result of the interview should be noted on a sheet of thin paper the same size as the card, which slip should be filed on the back of the card. When the deal is closed the details are transferred to another card printed with the same form but having a different color.

In such systems it is important to keep track of results. There should, therefore, be a monthly report giving in totals at the bottom the number of form and special letters sent out, the number of personal interviews, number of customers secured, together with an estimate of the cost. A comparison of results obtained in one month with those of other months will give valuable data. This, together with a careful estimate of the time to be required, will soon develop the cost required for securing customers by the month.

Mr. Frank B. Rae, in discussing the paper, thought that Mr. Almert was wrong in his general statement that central station men are unprogressive. He thought the correct statement would be that they are busy, and busy because they are unsystematic in the transaction of a vast number of duties. He stated that after figuring out how much money one can spend, all the different plans of publicity should be considered, and that adopted which seems to suit best the particular case. As to the several plans of publicity these consist of personal solicitation, mailing cards and circulars, and the newspaper. While the cost of newspaper space is in some cases almost prohibitive, if a local paper reaches practically all the better class of people in the town, a fair sized space, preferably about 5 inches, double column, should be filled with a series of advertisements planned in advance, and, if practicable, illustrated. The advertisements should deal in definite statements and not in glittering generalities. Advertising will do nothing more than bring an inquiry, and this should be followed up by personal solicitation. The solicitor should know eactly what a man should have, not what he wants or what would be the most profitable for the central station to sell him. In going out for new business the central station should economize for its customer in every possible way, and this can only be done by keeping in close touch with the progress of manufacturers in making new types of reflectors, lamps, etc. In introducing new applications, a sample should be obtained from a manufacturer, or a good picture and description, for submission to a prospective customer. An endeavor should be made to have the local paper print from time to time popular articles on electricity.

Mr. Wright emphasized the importance of using business courtesy in treating all customers from the smallest to the largest as if their business was wanted without regard to size. As to the qualifications of a salesman, Mr. Rae thought that he should go out with a definite purpose rather than be merely a "general mixer." Mr. Adams thought the "mixer" would gain many friends and makes sales frequently without solicitation. Mr. Greer thought that the most successful salesmen were not mixers alone, nor salesmen who presented a business proposition alone, but men with both of these and with other qualifications. President Williams, who is managing a recently established station at Lacrosse, Wis., said that his new company started a new business department before it started construction work. The company has now only been operating seven weeks and it has an average load one half the maximum. He thought that the unprofitable business with which so many companies are now loaded should, so far as possible, be gotten rid of. Mr. Gonzenbach thought it was not profitable to put in lamps merely for display purposes where gas is used, nor for six o'clock store lighting and factory lighting. Mr. Greer believed that central stations should take on every kind of business, and by a proper arrangement of rates and the use of a maximum demand system make every class of business profitable. Mr. Fred M. Kimball said that the aim should be to obtain some income from every foot of wire in the distributing system. Service should be gotten into every house even if it should only be at the start to heat the baby's milk. He believed a prime essential to be the establishment of show rooms in central station offices and that the office should always be located on a prominent thoroughfare. An endeavor should be made to have a description of new installations containing points of interest printed in the local paper and personal

items should be contributed noting that this person had put in a motor or that person had put in electric lights, etc.

Mr. Kimball did not consider that central station people as a whole throughout the country are open to the possibilities that lie before them. He divided the possible opportunities of any town into three classes. The possibilities of business in the first of these are self-evident and such business comes voluntarily to the central station. The second class of business is illustrated by the case of a grocer, who has been in the habit of grinding his coffee by a hand-operated mill for a good many years, and who should be induced to put in an electric motor. The third class may be illustrated by a concern which had been established a long time, perhaps is using considerable machinery without any thought ever having occurred to have it driven by electric motors, or who have been so situated that they never thought electricity would be available for their purposes. This was further illustrated by the case of a central station manager who had obtained substantially all the business in the first and second classes and finally started in to dispossess steam engines in his territory. He first started with a sawmill in which he finally was able to put a 36-hp, three-phase motor, and one of the inducements that led to obtaining business was working out a scheme whereby the customer added to his business the preparation and selling of firewood. In the case of a sawmill, the load factor is rarely above 40 per cent, the engine and boiler must be run all day, the steam power must be sufficient to overcome the momentarily very heavy loads thrown on the saw, which are easily taken care of by the overload capacity of a motor, and a large proportion of the power is wasted in the engine drive. A motor will easily meet the demands of a momentary excess of power, and when running at light loads power will only cost in proportion to the load, and the expense for power is cut off in the intervals between taking cuts.

Preliminary to getting down to business with a prospective customer, the solicitor should go through his plant, satisfy himself in his own mind just what can be accomplished in the way of saving, fix upon the best disposition of the machinery and, in fact, study the entire matter systematically and thoroughly. Several different plans of service should be drawn up and criticized from the customer's standpoint and then a proposition finally brought before him. The proposition should not, however, be forced to such an extent immediately as to run the risk of being turned down; just as long as one is able to hold a customer's attention without being turned down he has a chance of making a sale. If upon a visit a customer should show a disinclination to talk about business, he should not be pressed.

A class of customers worth going after are those located in by-ways. A great many people manufacturing little devices are tied up to an engine shaft in some back alley with no opportunity to bring the goods to the attention of the public, and who do not advertise. It is a good plan to endeavor to have these people move on to a main street, arranging at the same time to supply them with current in the new location. A good turn will thus be done for the customer in addition to getting his business. Mr. Kimball considered that the wave of manufacture is moving westward and that manufacturing will, to an increasing greater extent, be done in the West. Central station people in that section, therefore, should get their business into shape to take advantage of manufacturing development when it comes.

Mr. John S. Allen, of Beloit, contributed a paper on the proper handling of a new business department, and in opening commented on the unprecdented demand for new business managers and solicitors by public utility companies. The central station new business department, he said, naturally divides itself into three general parts, namely, solicitors, publicity and rates. He considered that no line of business offered better advantages to a young man than that of central station soliciting. He advised that solicitors give much attention to local affairs, study carefully the best technical journals and have files of these in the office for the benefit of prospective customers. In a town of about 10,000 inhabitants he thought it was essential that the company should have for the use of its solicitor at least six journals dealing with electricity and business and publicity methods. He recommend to solicitors Sheldon's course in scientific salesmanship. Of the money spent in advertising a large part should go to the local newspaper, and advertising copy should be changed every day. The copy should be pointed, consist only of interesting facts and be devoid of expressions intended to be catchy, but lacking in thought. A company in organizing its advertising department should select some expression which the public shall come to know as well as the company's name. He recommended the use of a special border around newspaper advertising, and that the location and form of the space should be changed from time to time. He also advocated the use of mailing cards, circular letters and personal letters. As to rates, he stated that from a system of flat rate charging progressive electric companies had swung to the other extreme of placing all customers on meters. Recently, however, some central stations have been making flat rates on various well defined kinds of lighting and upon some kinds of power. He considered it advantageous to give a flat rate on signs, window and other decorative lighting where a switch could be placed on the side of a building to be turned on and off by the company's patrolman. This class of business the company takes on a purely yearly contract. Central station managers, he said, should be careful not to get the idea that a low rate will of itself bring business, for it is a remarkable fact that the price of electrical current has very little to do with the amount which can be sold.

In the discussion of Mr. Allen's paper Mr. Rae said that he disagreed that the location of newspaper advertising should be frequently charged, the best plan being to select a good location on a good page and keep it. Mr. Allen said that while this was true of journals in large cities, in towns below 40,000 inhabitants the space devoted to actual news and to prominent advertisements is so small that much better service is obtained by allowing the publishers the utmost freedom in the location of advertisements changed every day. Newspapers take excellent care of this class of advertisements because it is to their interest to do so. Mr. Rae said that in starting a new business campaign advertising is designed merely to bring out inquiries as material for the solicitor to work on. An inquiry gives the solicitor a chance. As to rates, instead of giving a man a lower rate when he complains, his attention should be called to the subject of lighting efficiency and the central station manager should endeavor to see that his installation is made efficient from the illuminating standpoint.

In a discussion on the payment of solicitors, Mr. Korst reported that his company paid its solicitors salaries plus a commission on new business they obtained. He described a plan he had used with success in getting residence lighting where this is difficult on account of the cost of wiring. Residence owners are induced to put in electric porch lights at the flat rate of 50 cents a month and soon find that they want another light or two, and it is only a question of time when the whole house will be wired. Mr. N. F. Jewett, of Albert Lea and Chicago, said that companies in small towns that cannot afford a solicitor all the year round might secure temporary solicitors for a period of several months. Such temporary solicitors are available. In one small town such a man worked for sixty days and secured 75 customers for the company; he was paid $75 a month, plus $3 per customer secured. Mr. George E. Westover, of Cadillac, Mich., said that every man in his company's employ is made a solicitor. For each customer secured for 10 lights the employee is given either a half day's holiday or an equivalent amount of pay; for every customer for more than 10 lights he gets a day's credit in cash or vacation. His company has not been within 30 houses of being even with its wiring contracts in three years, the company doing its own wiring. Some of its men have obtained as high as two weeks' vacation for the new business they have brought in. Mr. Almert stated that reports of all new business secured by his company include the name of the employee who secured the business, which has the effect of developing talent in this line which otherwise might not be discovered.

Mr. Kimball had tried paying solicitors on a fixed salary and on a percentage of sales, and had dropped the latter method for the reason that a solicitor selling on a percentage sometimes sold things customers should not have. President Williams said that Madison, Wis., is divided into several territories with a

solicitor and assistant to each territory. The gross revenue each month is compared with that of the month a year ago and 7½ per cent of the gross increase is given to the new business department. Over and above payment of $30 a month to the solicitor, this percentage is apportioned to the different solicitors by means of a credit system, and different classes of business are assigned to a different number of points. As to the assignment of points, residence business for which an extension would have to be made and a new meter set would count only one point, and in taking on some business the solicitor would actually lose points.

The lighting until midnight of window signs counts 7½ points where there is no expense on the part of the company for a meter or for rendering a service. Mr. Williams said that the result of the application of the system referred to was a marked increase in consumption of gas and electricity. The electrical output at Madison increased some 32 per cent during the past year with practically no increase of demand, and this he considered to be due very largely to the system of paying the solicitors. If the business nets the company something, the solicitor gets a proportion of it, and if it is business the company does not want, it is up to the solicitor to make a good customer out of an unprofitable one. It is made as advantageous for the solicitor to retain the business he has secured as to get new business. On the basis of $30 per month, plus commission, some solicitors have drawn over $150, and the company would be gratified if they would draw $250. With a population of 25,000 inhabitants five solicitors are engaged.

Selling Signs in St. Paul.

The system whereby the St. Paul Gas Light Company, through the efficient labor of H. J. Gille, general superintendent, has installed some 200 electric signs of one make alone in its territory within the past two years, is interesting and worthy of study upon the part of lighting managers generally.

So far as possible, the flat rate is used, the lamps being turned on and off per schedule by patrolmen. This, it is the experience of the company, is the most satisfactory method for both parties, for the reason that the company knows just how many hours' service to figure on for the year, and the customer (or "the advertiser," as Mr. Gille cleverly designates the sign owner) knows exactly what he is called upon to pay for his electric advertising for the whole year.

The advertising method of approaching sign customers is worthy of note. Instead of added store expense, the whole subject is presented to the merchant as an advertising proposition, of equal, if not greater, merit, and upon a comparable basis, with newspaper or other well-established publicity methods. Tables can be presented to show the "circulation" of the electric sign (i. e., the number of people who would pass within its range each evening) and such figures show favorably in relative estimate with similar data on billboard, street car and newspaper advertising.

The introduction of electricity for advertising, as Mr. Gille well says, is necessarily an educational campaign to a very large extent, and not only patience but liberality upon the part of the company is essential to the successful development of this class of business. On this account, not only must the rates be favorable, but the solicitor for the company must do all in his power to eliminate technicalities from the preliminary talk and to smooth the way for the installation.

To the writer's mind the St. Paul company might have adopted even simpler methods, especially as regards the forms of contract. These contracts are two in number, one covering the use of current and the other a form of note and agreement stipulating terms and installment payments for the sign. Both of these instruments must seem somewhat staggering to the small merchant, who may want a twelve-light sign, but would be inclined to hedge upon sight of two contracts setting forth such an array of bewildering conditions which he must meet, while the company assumes no responsibility other than to accept his money and to receipt therefor.

The St. Paul company has an arrangement with a sign manufacturer whereby the signs are sold on an installment plan. This plan provides for twelve monthly payments for the sign, the collections being made in connection with the monthly collection for energy on the account of the sign-maker who credits the customer. In this way many signs have been put in service which would otherwise not have been erected, for the reason that the cost of an electric sign looks very large to the average small merchant, yet by splitting the payments he feels that he can pay this cost out of the benefits he receives.

This plan, while it involves a considerable amount of bookkeeping, clerical and collection work upon the part of the lighting company, is eminently fair, and results in much business that otherwise would be lost both to the sign-maker and to the lighting company. It enables the lighting company to place the signs on circuit without investment (as in cases where the free sign plan is used) and enables the sign-maker to carry this installment business on his books by relieving him of the expense of soliciting and collecting. Mr. Gille states that "the arrangement has worked out very successfully," in St. Paul, and the sign-maker points with pride to the fact that 200 of his signs grace the streets of the city. Evidently the success has been mutual.

"In regard to soliciting," says Mr. Gille, "all of the solicitors report prospects for signs and all the information in connection with the prospects are filed at the office and are followed up very carefully. Calls are made on a customer, a solicitor interviews a prospective customer for sign lighting and he suggests that he is not ready to consider the matter finally at that time, but gives some future date at which he will take the matter up. These follow-up cards are kept in date order, the solicitor taking the cards for his territory every morning covering that day and makes notes on the cards of any additional information that he secures. In this way no prospect is lost and they receive all possible attention. Another point to be remembered is the fact that by getting a customer to set a date at which time he will take the matter up, it assists the solicitor materially as it amounts practically to an engagement to talk signs with him on that day."

It will be understood that this business consists not only in signs but in decorative window lighting, and that the 200 odd customers so far connected represent only the first fruits of the preliminary educational campaign. If aggressiveness, persistence and broad business policy will win so much, is it not reasonable to expect constantly increased business when in a few years electrical advertising by merchants becomes the rule instead of the exception as at present?

Central Station Enterprise in Texas.

The following examples of central station enterprise are from Texas. To facilitate lawn lighting and encourage that practice in a certain town, a system of temporary wiring was devised whereby it was possible for two men to wire up 150 or 200 lamps in approximately an hour, the dismantling requiring much less time. Just a short time before a lawn party was to begin a wireman repaired to the house clad in spotless white duck suit, with a cap on which appeared the initials of the company. His duty was to look after the comfort of the guests in every way. For example, if he noticed that an elderly person was inconvenienced by a fan, he would slightly turn the fan in another direction. A burned-out lamp would at once be renewed, and if the affair was at the home of a non-patron, just a little extra attention was bestowed on the work. When lodges or churches had an oyster supper, the company would, if permitted, arrange to keep everything hot with electric culinary apparatus with no cost for service, cutting everything in ahead of the meter. Every case of "trouble" was promptly attended to and a receipt taken as evidence against the time when the man of the house would rise in his wrath and swear the matter had never been attended to. A receipt was also taken when the patron had a course in meter reading. The manager of the central station referred to was Mr. J. G. Boyd.

CENTRAL STATION SALE OF CURRENT

WHAT "COVERING THE FIELD" SHOULD MEAN TO THE AMBITIOUS CENTRAL STATION MANAGER.

A PROMINENT gas man, who was trying to secure a large advertising appropriation from his directors, was met with the reply that he had already covered the field. The answer was extremely characteristic of this gas manager. He replied, "Not so long as the Standard Oil tank wagons are doing business on our streets!"

This spirit electric light managers would do well to emulate, for none of them has the business he ought to have so long as *both* the Standard Oil wagons are on our streets, and the gas meters outnumber the electric light meters four to one.

The gas people began their publicity campaigns before the electric light interests were aroused. The average earnings of a gas meter are far below that of an electric light meter, and it would seem that the logical conclusion would be, that to secure an electric light customer, more money could be properly expended than to secure the installation of a gas meter.

Last month in this department advertising by printed publicity was classified under two general divisions.

(1) The indirect appeal, which generally consists of newspaper advertising, or any printed kind of advertising, which does not specifically solicit an order; and

(2) The direct form of mail solicitation, which specifically, and directly solicits the addressee's business, just as much as though a salesman had been sent to call upon the man and request his signature on an application blank.

But it is comparatively difficult to get a man to sign an order by mail and, therefore, the highest percentage of business obtained will be secured, not through an attempt to secure the order by mail, but to get "him" sufficiently interested to be willing to talk to a solicitor. If efforts are persisted in to secure merely an appointment for the solicitor, the resultant returns through the solicitor's efforts will be many times what would otherwise accrue.

Going to a man and personally asking him for his business, is a good old-fashioned way of getting that business, and you cannot beat it by any method of advertising, but if the advertising is combined with the soliciting, the advertising will pay handsomely. Any solicitor, be he ever so strenuous, will be affected by rebuffs. In consequence, a good deal of his enthusiasm oozes away by nightfall, if he has been met by a constant stream of negatives all day long. His efficiency will have steadily decreased during the day "inversely as the square of the resistance" he has met.

But if he had been wisely bolstered up prior to his calls upon the prospective customers by the proper advertising literature, which would have rained down upon the prospects a multitude of facts, figures and convincing arguments, as to why some particular form of electricity should be employed by that particular person, the solicitor would have been fortified, in particularly favorable instances, by an answer from the person to whom the advertising has been addressed; or if it were not possible to have secured such answer, he would at least have met a man, warmed up to the electrical proposition by reason of the campaign of direct mail solicitation waged before the solicitor called.

But, just as the solicitor must make a great many calls on the majority of his prospects before he has turned them into customers, just so the advertising matter should make a great many calls; and in making these calls, the advertising matter has a great advantage over the solicitor, in that, if it is prepared in an attractive enough manner, a great many calls can be made by mail without giving the recipient offense, whereas, anything like the same number of calls from the solicitor would probably be resented.

Then again the solicitor may call at inopportune times, whereas the advertising matter, if it does come at such a time, does not annoy the prospect as much as would a personal call, since it can be consigned to the waste basket, and so dismissed, in a much simpler and less annoying manner to the temporarily disgruntled recipient than a salesman could be dismissed.

The next piece of literature, be the reception given its predecessor ever so unfavorable, can probably secure attention a great deal easier than the solicitor could, and a long distance direct campaign can be carried on in this manner until the psychological moment arrives, when the person who has been solicited by mail is in a receptive mood. Sooner or later that time comes, and the continuous, polite, diplomatic, but everlastingly persistent, though always changing interrogatory, "When can we send our man?" is met with a favorable response. Meantime this automatic and systematic campaign has been waged without the loss of any of the salesman's force, and he has been kept busy, as much as possible, among the people who have favorably responded. The receptive attitude of the solicited has much to do with the amount of enthusiasm which the salesman can inject into his work. By this combination of advertising and salesmanship, the salesman's efforts result to much better advantage, for, not only does he work continuously at concert pitch, but his work, to a large extent, can be confined to the relatively favorable prospects, and this means a much higher percentage of contracts secured by the solicitor.

Proper advertising, persistently adhered to, is a magnificent force to be called to the aid of the salesman, but is not so directly productive a force as the salesman. and, therefore, as we have

Serial Number.	Month.	Day.	Year.	Letters.	Self-Addressed Envelope Enclosures.	Plain Envelope Enclosures.	Postal Card Enclosures.	Appointment Card Enclosures.	Return Postal Cards.	Advertising Cards.	Advertising Folders.	Special Pieces.	Small Enclosures with Letters.	Booklet Enclosures for Letters.	Booklets.	Remarks.
1																
2																
3																
4																
5																
27																
28																
29																
30																
Totals																

stated, to secure the largest possible returns per dollar expended, it should be wisely used as a direct adjunct to the salesmen or solicitors; but the advertising should never be called upon spasmodically or sporadically, but rather utilized as a steady continuous force, persisted in, not merely month after month, but year after year. The units of an advertising campaign should never be less than yearly units. Do not think of a flier now and then. Do not send out some booklet and expect the customers to flock immediately in upon you.

Secure proper advertising counsel, if you are not yourself equipped, and then set down and block out a campaign, like that indicated in the accompanying diagram.

The best way is to settle down, after filling out the diagram, using great care that no two pieces of similar advertising, either in idea, method of expression, color, or general characteristics, are sent successively. Then prepare all the sketches, dummies and copy for the various campaigns. Don't do this partially, but finish the job, working continuously on it until all the matter is ready. Carefully review the matter to see that it has the logical sequence, and that each letter or piece of printed matter put out, carries forcefully along the general thought; also be sure that you have not presented the subject in a dry, prosy, uninteresting fashion.

When this work has been undertaken in a thorough manner you can sit back with a great deal of satisfaction and watch the execution of your plans. If the work has been done by your advertising agent or whoever has assumed the responsibility of the position, in a thorough manner, you will have a comfortable feeling during the year, as your prearranged plans mature without calling upon you for much expenditure of vital nerve force after the plan is under way.

Your salesmen will be met on every hand with pleasant greetings, and while there will always be the crabbed citizen who objects to your intrusion, even by mail, yet, even this "sore-headed" portion of the community can be approached, and personal apologies very often but start an interview which results in his signature upon the contract—just as you had intended when you went to him to apologize for intrusion.

SYSTEMATIC AND CONTINUOUS PRESENTATION OF ONE LINE OF ARGUMENT.

The four main divisions in which business should be solicited, are, perhaps, in the order of their importance, signs, power, arc lights and residences. Local conditions may vary the prestige or prominence given these various classifications, but when a list of eligible names has been prepared, these names ought to be carefully considered with relation to what the prominent need of each individual case may be. Thus, it is possible that one prospective customer might be solicited for a sign, for arc lights and for power. In such a case as this it would be wise to put that particular name upon the sign list, and then for one solid year, pound him steadily upon the question of signs and nothing else. Don't divert his attention; don't weaken your case by talking anything to the receiver of this advertising but signs. Make him believe that without a sign, the front of his store is a great barren waste. If you began to divert his attention to anything else but signs, you will weaken your general cause, but if your advertising man is sufficiently skillful, he will arraign his many different arguments in line for an electric sign, and the subject will never be allowed to grow monotonous, since, though it is presented from twenty to thirty times during the year to the man's attention, it will in each instance be presented *differently,* and moreover, cumulatively.

Many people can be put upon the sign list, who are already customers for interior lighting and on the list should be included every merchant, whose place of business has a show window of any pretension, whatsoever, and, of course, there are many cases of eligible people who have not even a show window, and many instances can, of course, be remembered in each locality, where people, whose places of business are located up side streets, or in the rear of buildings, should find an electric sign an absolute necessity.

To all of these for a period of one year direct an incessant bombardment, ever presenting the subject from a new viewpoint, but always bringing it right home to the inner consciousness of the man, that the quicker he gets up an electric sign, the quicker he is going to increase his business by leaps and bounds, no matter how satisfactory a business he has at the present time.

But before you begin an advertising campaign, put up an electric sign conspicuously, over or in front of your office or plant. The selection of location should insure the greatest prominence possible to the sign. Be liberal in the candle-power and the number of the lamps. Make the sign a live affair. Do not have it conventional in any way. This can be done by borders of colored lamps, preferably red. Never use blue for this purpose, and no other colored light will give you the effect that red lamps will. It would be a good plan to put up several electric signs. If you are going to secure a liberal sign business from your citizens, the best plan is to take your own medicine in liberal doses before you prescribe it to others. After the sign or signs are up, keep the lamps clean and renew dim and burnt-out lamps frequently and systematically.

Just so the subject of electric power should be taken up with the people who ought to be using it, and to this list, a continuous stream of diversified, logical, sequential, and unremitting, forceful facts and figures should be presented.

The arc light lists should be made up of merchants or manufacturers, to which this form of light can be best adapted and the prevailing conditions in any one locality will readily indicate this; but where there is a conflict between signs and arc lamps —that is any indecision as to whether a given name should be put upon the sign list or upon the arc light list—it will be found in nearly every instance that the wisest thing is to first put such a name upon the sign list. A sign is to-day the most attractive leader that a central station can use as an entering wedge to secure a man's business and then, too, signs are extremely profitable for the investment employed if they are put forth under a **flat rate for a given number of hours'** burning, contracts being signed for one, two or three years, and the signs being turned on and off, either by a representative of the company, or by a time switch.

In this way, long-hour loads are assured, and it is worth while for the contract department to put in a little preliminary additional time geting a contract of this kind, rather than have the sign used for but short periods. A store can do no better advertising than to keep an electric sign burning until 11 or 12 o'clock every night, and experience in many stations has shown that where this is done, practically every sign can be put out on this basis.

If a man knows exactly what the sign would cost him every week and every month in the year, he has before him, not an indefinite number of kilowatt-hours, but a definite amount in dollars and cents which requires no mental labor in order for him to plainly understand what it means. He knows exactly what the cost will be, and if the subject has been skillfully presented, he is glad to sign a contract on a flat-rate basis, especially so since under most methods of charging, he gets a large number of the hours of burning in the "letters of fire" at a much cheaper proportionate rate than he would for a shorter period.

Lists of residences are, of course, easily made up, and they will embrace names along the streets where service already exists, or in nearby localities which are easily reached, unless there is a determination generally to extend the names in the residential sections.

Besides sign, residence, power and arc lists, there are a great many other lists that can be specially worked up, or have special letters written for them, such as window lighting, building outline lighting, ornamental exterior posts to burn all night, or ornamental statues.

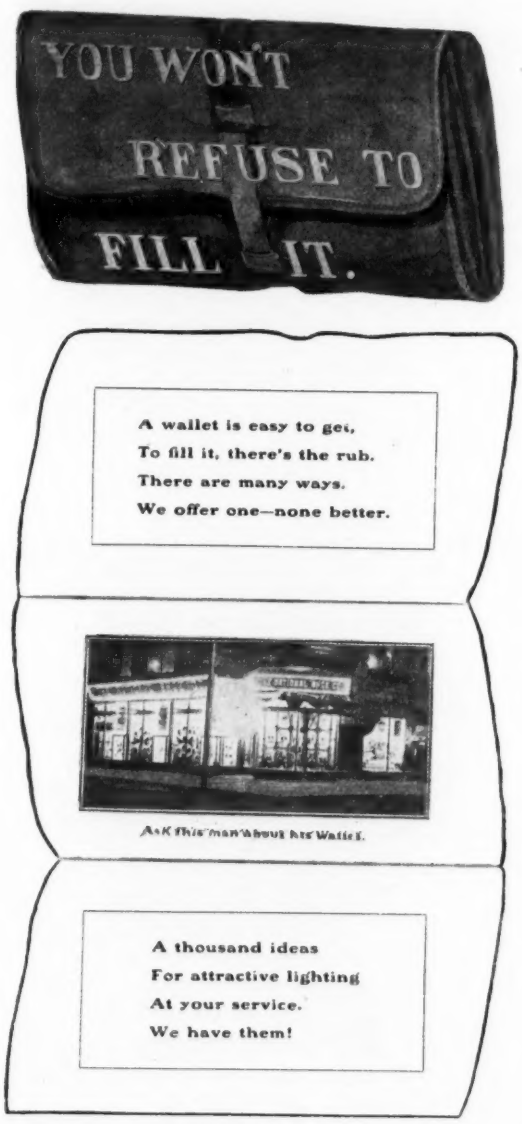
Then also, there have been, by some central stations, campaigns waged to induce the more free use of current by residences and stores, and in any central station which has not heretofore taken up the question of flat rate signs, a most excellent and productive campaign can be directed against present sign users; this special work being very closely followed up by the work of solicitors, or if there is a contract department, the head of the department could look after this business.

Such a campaign, intelligently fired at a man, and carefully combined with personal solicitation, cannot fail eventually to car-

ry the day. The returns from the second year of such a campaign in the number of "surrenders" will be much larger than the first year, and the third and fourth years will be even better; but care must be used not to let the list run dry, but new names should be continuously added as business changes occur, and as new people appear. The attention given these lists should be unremitting, changes being entered from the salesman's daily reports.

SOME EXAMPLES OF ADVERTISING FROM DENVER.

Here is an attractive example of advertising from Denver. The folder comes in the shape of a booklet, which on opening, displays three panels inside. The idea is a very attractive one. The middle panel is shown better in the original than our reproduction can make it, but a word of criticism might be offered, by suggesting that a more direct application of the moral



WALLET FOLDER.

might have been printed to insure the driving home of the point into the busy man's brain, who might give the picture but a glance.

Instead of asking "Ask this man about his wallet," it might have been better to have said, "Ask this man about his wallet—and how his electrically lighted signs and windows helped fill it." "Be plain if you would be understood," should be tacked right up in front of the advertising man's desk.

CO-OPERATIVE ADVERTISING BY ELECTRICAL MANUFACTURERS.

Last week an article appeared in these columns by Mr. J. Robert Crouse on the benefit of co-operation in electrical development, which subject is now attracting much attention among electrical manufacturers throughout the United States. There is no doubt that if these manufacturers will get together they can be the means of stimulating the use of electricity in many directions. Below are suggested some of the means that could be employed in furthering this end.

If the manufacturers work in the direction of general publicity, and the local central stations take real and full advantage of this general publicity by vigorously advertising, each in its own territory, the cumulative results ought to be of far reaching stimulation to the entire trade.

Here are some of the points of the application of which there should be profit:

1. Advertising co-operation by 607 electrical manufacturers.
2. Daily personal insistence on electrical apparatus and conveniences by the manufacturers' 610 salesmen during their travels. This insistence, if *continuously* applied against hotels, restaurants, cigar stores, etc., would have a far-reaching effect. As an example, let the salesmen patronize the cigar stores having electric signs; let them ask for electric lights, etc., etc. They would then all tend to help each other.
3. Advertising co-operation by the 453 electrical jobbers.
4. Advertising co-operation by the 1,500 electrical contractors.
5. Advertising co-operation by the salesmen of electrical supply houses, along the same lines as indicated for the manufacturers' salesmen.
6. Co-operation by the technical press.
7. Special co-operation by a committee of the National Electric Light Association, or a branch of that organization known as the Commercial Branch.
8. Special co-operation by a committee of the Northwestern Electric Light Association.
9. Special co-operation by the various state electric light associations.
10. United efforts from all the trade to induce co-operation by architects, builders, contractors and real estate dealers.
11. General advertising campaign in magazines.
12. Electrical shows and expositions.
13. United co-operation of the American Electrical Sales Association on the same lines as the manufacturers' salesmen would proceed. (The new organization of salesmen.)
14. Enlisting the co-operation of the Rejuvenated Sons of Jove by the same methods as would be employed by the American Electrical Sales Association. (This is a society recently formed and composed mainly of electrical people.)
15. Direct plans of mail solicitation against the actual prospects by local central stations.
16. Newspaper advertising by local central stations.
17. Systematized follow-up correspondence by central stations against each local specialized trade, which might employ electricity profitably in some form.
18. Let each central station maintain either in connection with its office, or separately, a sales or show room for the display of electrical apparatus; not forgetting an attractive show window and an electric sign to draw public attention.

All these methods, if employed together, and seconded by central stations in soliciting business by an active and continuous canvass in addition to the local advertising could not fail to achieve returns.

Concerted effort always produces results that are larger than can be brought about by individual effort, and the central stations should not be behind hand.

Isolated Plants Abandoned in Chicago.

The Chicago Edison Company and Commonwealth Electric Company have secured some excellent contracts in the past few months for light and power from large concerns formerly operating isolated plants. One of the most notable of these is "The Fair," one of the largest department stores, which occupies an 11-story building covering one-half a city block and has always heretofore operated its own light and power plant. Another large contract is that of the Griffin Wheel Works, a car wheel factory which formerly operated a 550-hp compound Corliss engine. The power of the wheel works is now supplied by three-phase motors.

Business-Building Methods of the Public Service Corporation of New Jersey.

THE light and power territory of the Public Service Corporation of New Jersey, embraces towns and cities of from 2,500 to 300,000 inhabitants and a total population of over 2,000,000. The same general methods of business getting with respect to electric lighting and power are applied in all of the communities, large and small, with equally satisfactory results.

The methods pursued are broadly of two kinds—advertising and soliciting. A little over two years ago the details of increasing the corporation's business were confided to one management with the head office at Newark, N. J. Before this time each local company head had in his own territory personal supervision of the means employed, but in the fall of 1903 a commercial department was established with Mr. Percy Ingalls at its head and Mr. C. W. Lee its advertising specialist.

FIG. 1.—COVER OF "LIGHT AND POWER."

Pamphlet, circular, novelty, and newspaper advertising is supplemented by personal solicitation of salaried solicitors who follow up the inquiries that come in as the result of the advertising campaign.

The monthly pamphlet called *Light and Power* was first issued July 1, 1904, and has grown from eight to sixteen pages, containing bright and timely educational matter attractively illustrated, pertaining to electrical subjects of general and local interest. Photographs are given showing power installations and attractive lighting effects obtained by customers, and the fact brought out, that electricity from the various plants of the Public Service Corporation is used more and more every day and in all important buildings, the owners finding it cheaper and more satisfactory than producing their own electricity. The monthly bulletin is sent to users as well as prospective customers, and is considered the most important feature of the plan.

Circular letters in fac similes on special topics signed by the local agent are put out as part of the follow-up campaign, with the intention of stimulating replies. The possibilities of the uses of electricity are brought out very clearly in these letters, as well as in folders and booklets and stickers used in between the mailings of the pamphlets. From twenty-six to thirty mailings a year go to each "Prospect" on the list.

The periodical, *Light and Power,* does not go to all customers, but only to a selected list of names of those judged by the local agent as most likely to help circulate the information contained therein. Folders and novelties are mailed and attractively printed with seasonable artistic designs calling attention to the benefits

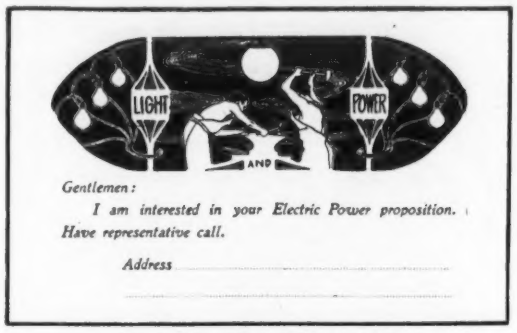


FIG. 2.—RETURN POSTAL CARD.

of electric service. A return postal card accompanying the class of literature is shown in Fig. 2.

Monthly calendars are also used as part of the follow-up campaign for electric power. The calendars are small and rendered artistically attractive by being lithographed in colors. This calendar is the best of the novelties used by the corporation since it is not only attractive, but as a calendar is more likely to be preserved. Slipped in somewhere is a printed circular calling attention to the merits and benefits of electric power. In the

FIG. 3.—CALENDAR.

specimen illustrated in Fig. 3 the circular is enclosed in the small envelope.

Pasters are attached to all bills. Those going to private houses have some matter concerning the home. Those going to stores have matter pertaining to store lighting, window dressing and general uses.

Street car advertising is successfully employed by the corporation, seasonable topics being artistically presented.

Sign lighting and brightly lighted and well arranged show rooms at the office of each territorial district are made a feature. Fixed illuminated signs were undertaken on the meadows paralleling the railroads between Newark and Jersey City, but much trouble was experienced in maintaining them. A number of such signs were stripped by wire thieves who took everything, even to the transformers, so after replacing the signs several times the expense was deemed too great and this method abandoned. Illumi-

nated signs at each office, with changeable letters, were adopted, with which the several branches of the business at different seasons is advertised. The signs do not give the name of the company, as the advertisement of some department of the business calls attention to the office as well as the specific thing advertised, thus serving a two-fold purpose.

The free sign proposition is an instance of the aggressive sign campaign. Two classes of signs are supplied by the corporation —panel and monogram. The basis to the customer is the regular local lighting rate and a minimum monthly charge of $5 for the panel sign and $1 a letter for the monogram signs. Flat rate with a patrol system is also used where warranted, the sign current being kept off until 6.30 o'clock in the evening during the winter months. This time limit avoids the peak of the station load and enables an inducement in price to be made to the sign customer. The sign wiring is brought outside the building to a locked box, containing the switch, the current being turned off at stated times, depending upon the contract with the customer.

The corporation supplies the sign complete, including wiring, erection, lamps and maintenance. A 4-cp, 5-watt lamp is used. The average income from panel signs is $7 a month and from monogram signs about $2 per letter per month.

The use of the changeable sign in large sizes, with its ease

Six Blistering Weeks.
The weather man says they are coming. An Electric Fan will give you comfort and pleasure during that time. Don't suffocate when relief is at hand. Electric Fans $9.50
A Cool Meal
a cool room, is possible on a hot day with a
BLOWER FAN
Price, $9.50
Holiday Suggestions.
Electric Portables for the study table and Electric Lighting outfits for table decoration and Christmas Trees. Exhibition at show room.

FIGS. 4, 5 AND 6.—SPECIMENS OF PASTERS.

of enlargement permits of elasticity in supplying the needs of some customers. The units and face plates of the Mobile signs are purchased by the corporation and the signs are then made up by its own staff. It is considered of great advantage to have a standard sign since a special one would serve for but one customer who might go out of business in a year's time. The expense of the sign in that case would be a loss whereas with the standard sign the change necessary for another customer would only amount to from $3 to $5. The free sign proposition has only been in vogue one year. Below is a reprint of a letter sent to prospective sign users:

"While passing your place of business last night I noticed that you were still without an electric sign. Why?

"Our free sign proposition puts this popular advertising medium within the reach of every merchant in our community.

"There is a time when conservatism ceases to be a virtue. The electric sign has proved itself a magnet to the trade and a money getter, so get in line.

"If you are in business for pleasure you need a sign to make you feel that your place is as good to look at as the one across the street. But if you are there for your bread, butter, jam and automobile you must have a sign to get your share of trade. You see it's a sign which ever way you turn.

"A bright store makes a goodly-sized bank account.

"Let our representative have a talk with you on the store lighting and sign proposition. Ten minutes' time may make a ten per cent increase in the paying capacity of your business. Our interests are one, your success is ours."

As a result of the sign campaign, this business has grown from 35 electric signs in 1904 throughout all the territory, to nearly 600 signs of both kinds to-day, with an income from this source of over $60,000 per annum.

Newspaper advertising accomplishes a double mission. For aside from its commercial value to the corporation it establishes friendly relations with the press. The space is mostly used to appeal to the greatest number of people, which means continuous talks on the subject of household necessities in private houses.

All the advertising matter is prepared well in advance of its actual use. The cost of reaching prospects has been the small sum of between 83 cents to $1 a name per year. No other commercial business would be contented to spend so little in reaching a prospective customer, and yet this relatively small sum has produced results that should awaken every central station man to do something in this advertising line in order to stimulate a further increase in his business.

In the expenditure of an advertising appropriation the results are what count and the follow-up feature is as important as the basic advertisement. The experience gained by the Public Service Corporation shows the necessity of spreading the work done over the whole year and not permit the whole outlay to go out in one effort in one publication.

The soliciting by agents is a necessary and important adjunct. In some of the smaller fields of the corporation the local agent is also the superintendent of the plant, but this is the exception rather than the rule, as the business getting is held to be an entirely different department from the one producing electricity.

The solicitors of the Public Service Corporation are paid on the salary basis, but are encouraged by prizes of $50, $30 and $20 for the best six months' work for obtaining the greatest number of 16-cp equivalent connections. No premiums are offered nor given to their own or to outside wiremen. In the residential districts the greater amount of soliciting has to be accomplished in the evenings in following up inquiries as the result of the advertising campaign. Each solicitor turns in a daily card reporting the different calls made, every one having his own separate district. The commercial department keeps close watch of each solicitor's work. The solicitor is occasionally changed to a different territory with good results.

The great success of a solicitor in residential territory was a mystery for many months and until his method was discovered. This consisted, after finding a prospect, in telling all the local wiremen about it, the result being that after a few weeks the prospect requested a visit from the solicitor and a contract was signed.

For the data obtained in this account thanks are due Mr. Percy Ingalls, manager of the commercial department, and to Mr. C. W. Lee, of the C. W. Lee Company, of Newark, the advertising agents for the Public Service Corporation.

New Telephone Patents.

SPIRAL CORD.

Since the success of the steel switchboard cord has been thoroughly demonstrated, it is but natural to find the same general scheme applied to other classes of cords. Such an application of the spiral principle is shown in Fig. 1, in a cord for receivers,

SCHMIDMER FLEXIBLE CONDUCTOR.

etc. The foundation of the cord is a fibrous core or string, about which the conducting strand is wound in a regularly spaced open spiral. This method gives flexibility and strength. The conducting strand itself consists of a metallic ribbon closely spiralled about a twisted fiber core. G. E. Schmidmer, of Germany, is the inventor of this cord.

RECEIVER.

C. G. Burke, of Brooklyn, has patented a double-wound re-

ceiver. It is his idea to provide a fine and a coarse winding, and by this means produce a substitute for the usual induction coil. He includes the low winding of the transmitter circuit as a primary, while the high winding bears the usual relation to the circuits of the telephone receiver.

PARTY-LINE SYSTEM.

A step-by-step party-line system of a rather novel sort forms the subject of a series of three patents granted to Messrs. A. F. Poole and F. B. Hall, of Wheeling, W. Va. One side of the line is normally cut in two at each station, and the line has to be built up for each call. The instruments are all disconnected until cut across the line by electromagnetic means under the control of polarize electromagnetic means. Provision is made to enable calls to be sent from or to the line or between stations, on the same line. A complete sub-station and switchboard system has been worked out.

INTERCOMMUNICATING SYSTEM.

R. M. Beard, of New York City, has patented an intercommunicating system which involves no common wires in the talking circuit. Each station has a wire incoming from every other, and also a wire outgoing to each other. In talking, the calling station selects one side of the circuit, viz., its wire to the desired station. The called station selects as the other side of the talking circuit its wire to the calling station.

LETTERS TO THE EDITORS.

Efficiency of Lighting Balancers.

To the Editors of Electrical World:

SIRS:—The question raised by Mr. Wilkinson in your issue of January 13 is an old acquaintance. It is the opinion of many engineers that the term "efficiency" should be used exclusively to express the ratio,

$$\frac{\textit{transformer power}}{\textit{transformer power} + \textit{losses}}$$

This seems to be the legitimate use of the word. The substitution of the word energy for power, giving the term "energy efficiency," seems a rational corollary, but further than that the definition should not be extended without the sanction of some authoritative body of scientific men.

Unfortunately the A. I. E. E. standardization report does not deal especially with the case in question, but it does define the efficiency of a motor-generator as the generator output divided by the motor intake. This and the foregoing are my sole reasons for using the terms "motor-generator efficiency" and "balancer efficiency" synonymously. I consider the reasons sufficient, but grant that there is ground for disagreement. In any case the conclusions of the paper in question will not be invalidated, as the efficiencies *Eg* and *Em* are used to determine current distribution.

There is much to be said on Mr. Wilkinson's side of the question, however. The operation of a two to one auto-transformer is a close analogue to that of a direct-current lighting balancer. The natural interpretation of the A. I. E. E. standardization report, under the section entitled "Stationary Induction Apparatus," would make the efficiency a ratio similar to that which Mr. Wilkinson uses for the direct-current balancer. It is not an efficiency of conversion. As is true with the direct-current-balancer, less than half of the unbalanced power in the secondary mains is converted by the apparatus. However, the auto-transformer *can* be used as a lighting balancer.

Again, many customers may look at the problem in this way: Here is a piece of apparatus. The output is a certain quantity. The intake is a certain larger quantity. Therefore, the efficiency must be the ratio of the first divided by the second, regardless of whether all or a part of the power be transformer.

The high efficiency as determined by Mr. Wilkinson is attractive to the salesman, but further than that it has no special advantage. The customer is interested chiefly in the number of volts by which his line will be unbalanced regardless of what output is taken as the basis for ascertaining the percentage of regulation, and he seldom asks for an efficiency guarantee. When he does, the efficiency may be given for each unit composing the balancer, the efficiency of conversion may be quoted, or that as calculated by Mr. Wilkinson; but each party to the contract should have a clear understanding of the basis of the guarantee. In lieu of a definite understanding, the efficiency of conversion is safest to use because it is the lowest and leaves no ground for dispute.

As to the term "combined armature efficiency," I meant the ratio of the output of the generator armature divided by the intake of the motor armature; that is, the motor-generator efficiency computed exclusive of the field excitation loss. This was clearly indicated in my article on page 1067 of the December 23d issue.

I thank Mr. Wilkinson for raising this question of definition, and express the hope that our standardization rules may some day be perfected so as to leave no ground for controversy.

NORWOOD, OHIO. BUDD FRANKENFIELD.

Increasing Central Station Business.

To the Editors of Electrical World:

SIRS:—I notice in your issue of January 13 that you have a very interesting article on the electrical distribution system of the Public Service Corporation of New Jersey, occupying four pages. I also notice in the same issue the second part of an article on "Central Station Economics in Massachusetts," and a page and a half devoted to notes on central station business and getting new central station business, in which are advanced suggestions for increasing the central station business. This latter, by the way, is a valuable feature in your paper, aiding as it does the central station man to get ideas for expanding his own business and thus increasing the use of electrical apparatus which will benefit your manufacturing friends.

Having just read the Public Service Corporation article and the business-getting articles above referred to, I was quite interested when I stepped off a train the other evening in one of the cities which is lighted by the Public Service Corporation to note the following condition:

A jewelry store with a flaming gas jet and some paper packages on a shelf some three or four feet above the gas flame, the store evidently closed for the night and the fire danger imminent. Adjoining the jewelry store was a barber shop, also lighted by gas, next door to that a saloon and then a livery stable with more flaming gas jets in dangerous places. Next to that was a newspaper office and a little further on a Chinese laundry, all of which were gas lighted and all of which were dangerous spots. It occurred to me that the insurance rates on that block must be very high, the lighting was decidedly unsatisfactory and it would seem that if the Public Service Corporation were as progressive as some of the other companies whose business methods you have been extolling, they would long ago have shown the proprietors of the various establishments enumerated above the danger and folly of continuing to use gas. There must be scores of other places where central stations are not making the necessary effort to induce their possible customers to try electricity in place of the old gas jet, and I bring this matter to your attention simply as an object lesson.

It may be that one reason why the block in question is lighted by gas instead of electricity is the high rates charged by the Public Service Corporation for making a connection. A few months ago a tenant of one of my houses asked me to have his house connected with the Public Service Corporation mains. I asked the latter company what the cost would be and was informed that it would be $100, in consequence of which I did not have the connection made. The tenant in question is a man of means and they have missed a good customer because of their short-sightedness in making so exorbitant a demand for their connection, which does not strike me as being good business. As I said before, these facts are cited merely as examples of neglected opportunities.

EAST ORANGE, N. J. W. M. JAMES.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Interpole Construction of Direct-Current Dynamos.—DETTMAR.—The introduction of interpoles or commutation poles into practice should result in remodelling the design of direct-current dynamos which was worked out in the past with special reference to the necessity of providing good commutation. Since this result is now guaranteed by the provision of interpoles, it is no longer necessary to take it otherwise into account, and the design may be changed in many respects so as to get cheaper machines. While formerly very strong fields have been adopted with a high flux density in the air space and in the armature teeth (in order to prevent the field distortion) resulting in an increase of the copper on the magnets, it is now possible to reduce the cost by reducing the number of lines of magnetic flux and increasing the number of the armature conductors. It is no longer necessary to give a special form to the main poles. The number of commutation segments, which has been very much increased in recent years, may now be reduced, which reduction will lessen the cost and increase the strength of the commutator. In the choice of the number of poles one was formerly restricted by considerations of good commutation. Since this is no longer necessary it will be possible in many cases to reduce the weight of the machine by increasing the number of poles. It is further possible to improve the efficiency of the machines by the employment of interpoles so as to come nearer the conditions as they obtain with transformers. The efficiency may be increased for low loads and this is of special importance for such motors which do not always run at full-load. It will be possible to admit some distortion of the field, although the so-called additional losses are thereby increasd, the author describing a method of determining them. The loss due to the friction of the carbon brushes is not negligible, especially with 110-volt machines. This may be decreased since it is no longer necessary to select that kind of carbon which is best for good commutation. The carbon may now be selected to get the lowest friction. It may also be possible to introduce now into practice mixtures of carbon with metal which heretofore could not be used on account of their detrimental effect on commutation. Further the commutator may be made smaller. Interpole construction should be especially favorable for low-voltage electrolytic generators and for boosters. The connections of motors to street railway networks are now increasing in many German cities. For instance, in Dresden there are now 350 motors, having a total of 1,900 hp connected to the network of the street railways. Such consumers who have a very intermittent load, are thereby kept away from the lighting network. In connecting the motors to the tramway supply it must be taken into consideration, however, that such systems show considerable voltage variations, sometimes amounting to 40 per cent. This will cause a change in the speed of the motors. In many industries this will not matter much, but where it does, the disadvantage may be avoided by employing motors with a weak field. This is possible without an undue increase of cost, by using interpoles. The provision of interpoles also enables the design of machines in which the speed may be changed within very considerable limits, by simply varying the field. On account of the necessity for obtaining good commutation, direct-current dynamos have been built in the past mainly for electromotive forces not over 700 volts; for large generating sets not over 1,100 volts, or in extraordinary cases 2,000 volts have been employed. With the use of interpoles it will be easy to at least double the voltage. This should have an important effect on direct-current traction and simple power transmissions. If machines with interpoles are built with full utilization of their inherent advantages, it will be found that their price is not higher, and probably somewhat lower, than that of the present standard machines. It may, therefore, be assumed that there will be a tendency in the future to make interpole construction the rule.—*Elek. Zeit.*, January 11.

Alternator Construction.—An illustrated description of a new construction of alternators used by the Felton & Guilleaumme-Lahmeyer Co. The special feature is that the exciter is placed within the bearing case as shown in Fig. 1. The bearing case,

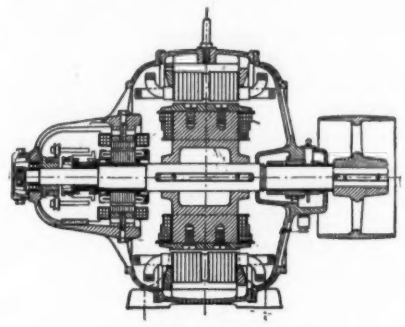


FIG. 1.—ALTERNATOR CONSTRUCTION.

therefore, forms at the same time the magnet yoke for the machine. The bearing shield and the magnet yoke are cast in one piece. The four poles made up from iron sheets are screwed to the yoke. A common box is provided for the armature commutator and the slip rings which are placed close to the latter. The whole revolving part of the exciter is independent of the alternator and may be taken from the axle when repairs are necessary without disturbing the alternator. The advantages claimed for this arrangement are a more compact and stronger construction and less weight, although the axle is, of course, somewhat heavier.—*Elek. Zeit.*, December 21.

Exhibit.—REYVAL.—An illustrated description of a gas-driven generating set exhibited at Liege. The gas producer is of the Ficht-Heurtey type, and a Koerting gas engine drives a 450-kw, three-phase generator, the voltage being 2,000, the speed 125 and the frequency 50. Details are given concerning the design of this generator.—*L'Eclairage Elec.*, December 30.

Lights and Lighting.

Street Lighting.—HARRISON.—The conclusion of his paper, the first part of which was recently abstracted in the Digest. Since he considers that the efficiency of street lighting must be judged by the minimum illumination obtained at any point, he has devised fittings with this special purpose in view. He emphasizes the following facts: The rays directed above the horizontal are useless, and therefore can be diverted up and down the street to increase the distant illumination. If the posts are erected on the edge of the footpaths, the raps which would illuminate the adjacent houses or fields are practically useless, unless the houses have a reflecting value, which is very rarely the case. The rays of light illuminating the street near the post should be of small value compared to those directed to a distance up and down the street, in order to obtain even illumination. The author has devised on this basis fittings of such design that the following results are accomplished. The average candlepower of the lamps measured from all parts of the street will be found to be 2.2 times the mean spherical candlepower, and the maximum candlepower measured over the width of the road, some distance from the post is nearly three times the mean spherical, the minimum candlepower measured adjacent to the post being equal to the mean spherical candlepower of the lamps. Results of tests are given from actual practice, and various figures are given on the cost of maintenance of various types of lamps, both electric and gas. From these tables it appears that the use of large units of light for general street illumination is expensive and should be avoided where possible. Further the cost of maintenance is very often as high, if not higher, than the cost of electrical energy or gas. The author finally speaks on the current supply for electric street lighting, and recommends a separate network which is stated to result in a considerable sav-

ing. As a suitably designed system, he mentions that of Wilkinson which consists of cables laid in gas barrels situated underneath the flags or paving adjacent to the curbstones. Osmium and tantalum lamps he considers as specially suitable for street lighting, and recommends to use them in the form of low-voltage lamps (10 to 30 volts), with thick filaments, intended to be run in series throughout the street, controlled at the end of each series by a magnetic relay switch connected to the previous series in a manner similar to that used for arc lighting. A very simple cut-out prevents a fault in any lamp extinguishing the series. He gives an estimate of cost, from which he concludes that even when including interest and sinking fund on all materials and mains, street lighting can be carried out at a profit by means of electricity at a price far below the average charge for gas when giving the same result as regards illumination.—Lond. *Elec.*, December 22.—An account of the discussions which followed in Lond. *Elec.*, December 29.

Public Lighting.—Simmance.—A report on the public lighting of Edinburgh, both with gas and with electricity, the results being given in tables and diagrams. The report speaks very favorably of the arc lamp used in that city. "The steadiness of light is very satisfactory; and the light at the angles approaching the horizontal is far greater than in many types of lamps. It must be observed that the value of a lamp for street lighting is not measurable by its mean hemispherical intensity. The bare arc invariably gives its greatest results at angles from 40 to 50 degs. from the horizontal, but at 5 deg. and at 0 deg. the light is very small. With a gas incandescent lamp, the greatest light is, of course, horizontal to the mantle and the depressed degrees from it; and this affords an advantage over arc lighting in most cases. But the arc lamps used in Edinburgh afford a very considerable light at the longer distance, and thus must be looked upon as eminently satisfactory." The greater height of the electric lamps gives the rays forming the more acute angles with the ground a further reaching effect, and thus the more distant lamps afford more useful aggregate distance light than the shorter gas columns can do; "and I, therefore, should have no hesitation in stating that the 10-amp. lamps could do the work of three times the number of 3-ft. incandescent gas lamps in fairly straight streets where the height of the electric columns gives that system the advantage."—Lond. *Elec.*, January 5.

Lens Lamp.—An illustrated note on the Boehm lens lamp. The only difference between this and an ordinary lamp lies in the design of the globe, the glass being not merely corrugated, but being shaped to form an actual lens. The object of this is to concentrate the light in a certain direction (usually in the direction of the lamp axis).—Lond. *Elec.*, December 22.

Power.

Steam and Gas Power in European Stations.—Rubricius.—A review of recent developments. The Berlin electricity works are now installing in one station two reciprocating steam engines, each of 6,500 hp. The steam consumption of one of them was found to be 4.03 kg. per indicated hp-hour. While in the United States vertical engines are generally used, the horizontal type is preferred for large units in Continental Europe and also mostly in England. The following types of steam turbines are now being used in Europe: The Parsons-Brown-Boveri turbine; the turbine of the Allgem. Elek. Ges., which is a result of a combination of the Riedler-Stumpf and Curtis types; the Zoelly-Escher-Wyss turbine; and the Union turbine of the Union Company in Essen. In France the Rateau-Sautter-Harlé turbine is also in considerable use. In the new central station of Essen-Ruhr two 10,000-hp Brown-Boveri-Parsons turbines have been in use for 5,000 to 6,000 hours and have proven perfectly satisfactory. Each turbine has a weight of 190 tons, including the electric geenrators (a three-phase generator of 5,000 kw and a direct-current generator of 1,500 kw) which are connected to the horizontal axle of each turbine by means of elastic couplings. In spite of this large capacity the dimensions of the turbines are relatively small. The total length of each turbine with the generator is 20 meters, while the height of the set is not over 2.6 meters. The guaranteed steam consumption is not more than 4.08 kg per hp-hour. Two other turbines of the same size are now being installed in Vienna, while a 12,000-hp unit has been ordered. The new power stations in Frankfurt, at Porta Volta in Milan, at Puteau near Paris, at St. Ouen near Paris and the Chelsea station in London, are all equipped with large steam turbines of 2,000 to 6,000 kw. Gas engines of a capacity of 1,500 to 2,000 hp are now no longer anything extraordinary. The operation of gas engines with blast furnace gases has produced important industrial changes and great savings in iron blast furnace districts. The thermal efficiency of the modern large gas engines averages about 30 per cent, and their design has been so improved that they may be directly coupled with the electric generators. For small power stations, suction gas engines have obtained considerable commercial importance.—*Elek. u. Masch.*, January 7.

Steam Turbine Station Design.—Sniffin.—An article pointing out that the steam turbine is no longer a matter of speculation. The reasons for the surprisingly quick introduction of the steam turbine into engineering practice are summarized. While turbines have previously as a rule been installed in power plants more or less conventionally designed on the lines of piston engine practice, there will soon be some typical turbine plants with their various other features and general arrangement co-ordinated to the simplicity and compactness of turbine design, and much of the present day complexity with its attending expense will disappear. Two such plants are now being designed for Ft. Wayne, Ind., and for Hamilton, Ohio. Boilers will be on the ground floor, the turbine located directly overhead; thus the steam and exhaust runs will be short and direct, the initial steam coming up and the exhaust going down, as they should. The exciters are put on the generator shaft, thus eliminating separate exciting units; in fact the stations will contain as little in the way of auxiliaries as possible. There will be some saving in building construction, considerable saving in ground space, and "it would not be surprising if the whole station, including ground, were to show a reduction in first cost per kw of 25 per cent on the usual capital account of such properties."—*Elec. Jour.*, January.

London Conference on Smoke Abatement.—An account of the recent conference and exhibition on smoke abatement in London. An address of Sir Oliver Lodge pointed out the unsanitary effects of fog. While the electrification of air on a large scale would be the proper method for dealing with river and sea mists and in general with fogs of a non-avoidable kind, it would need considerable capital expenditure to try it on a large scale. The right way of dealing with a town fog is not to permit imperfect combustion. The authorities should insist that the material burned should attain a moderate average of purity. Processes involving the use of solid fuel should not be carried on in a big city, but should group themselves round the coal field so that the cost of carriage might be small. The gaseous product, on the other hand, readily lends itself to purification and transmission. Gas is now usually burned under very unsuitable conditions. An important condition for complete combustion is that there must be no cold surface to interfere with the ignition. Gas must be raised to a certain temperature before it will ignite. "In many domestic grates there is far too much iron; by rights there ought to be nothing but non-conducting material within reach of the flame." A paper by Shaw discussed the question whether London fog is inevitable. He pointed out that there is nothing physically impossible in the idea of dispensing with coal smoke; this would dispense with about 20 per cent of London fog while the remainder depends upon physical processes not within human control. Cohen presented a record of the works of the Leeds Smoke Abatement Society. Rideal pointed out the excessive amount of sulphurous acid in the atmosphere found in districts where much coal is burned. Ackerman discussed the distribution of producer gas as a means of alleviating the smoke nuisance. Martin traced the connection between smoke prevention and coal conservation. Sir William Preece in an address emphasized the necessity of improving the methods of combustion. Cahorne called attention to the importance of the employment of only trained men as stokers, stating that the efficiency of several forms of smoke-consuming appliances depends more or less upon careful attention of the stok-

ers. He does not think that mechanical stokers will supersede hand-firing to any extent. Rideal summarized the replies received from 38 factories to a circular letter. Three consumers have substituted gas engines for steam plant. Thirteen firms ascribe their success in preventing the emission of smoke mainly to careful stoking. While not denying the efficacy of many mechanical devices, yet the general consensus of opinion favors skilled and careful stoking as of the first importance. Kershaw discussed the aims and work of the Hamburg Smoke Abatement Society. Several other papers dealt with legal questions.—Lond. *Elec.*, December 22, 29.

Traction.

High-Speed Traction.—MORRIS.—A paper read before the Engineers' Club of Philadelphia, giving a review of the present tendencies toward high-speed electric traction and dealing especially with the "motor-cycle" railway. Upon the ties of standard road beds a central supporting rail is placed, leaving steam locomotives free to handle freight or other traffic over the two existing rails which also afford support for the balance wheels of the "motor-cycle" trucks. The motor-cycle car is carried on two trucks, the weight of the car body being concentrated on two motor wheels placed tandem in each truck, and running on the central rail. Two balance wheels on either side of each truck travel on the outer rails. The advantages of electric transportation are said to consist not only in concentrating the generating power plant for an entire system at one point, but in concentrating the weight of each car over the driving wheels that propel it instead of at the head of the train, trailing a dead load behind. The motor-cycle system not only concentrates the weight of each car over its four driving wheels, but makes these wheels themselves the motors and places them in direct alignment on a single rail. This is thought to reduce the problem of traction to its simplest and most direct form, and to render "enormously high speeds" possible "with economy, comfort and safety."—*Proc. Engineers' Club of Phila.*, January.

Chicago and Milwaukee Railroad.—A fully illustrated article on extensions and improvements on the Chicago and Milwaukee electric railroad. Plans are being completed for a new power house and a complete overhauling of the high-tension distributing system. The new power house will have an ultimate capacity of 45,000 kw and will be located at the central point of the system. Turbo-generators will be used. Current will be transmitted to sub-stations at 33,000 volts.—*St. R'y Jour.*, January 20.

Installations, Systems and Appliances.

British Central Station Statistics.—The first of the annual "tables of electricity supply and traction undertakings of the United Kingdom." The present table covers central stations with no tramway load. There are now in operation 262 such stations about which a large amount of information is given as to equipment and system. This number is now slightly less than last year, since the number of lighting stations which have added a traction load during the year is greater than that of the new stations opened for lighting supply only. The number of new stations in progress is small; this is largely accounted for by the increasing number of districts in which supply is taken "in bulk" from a large power house outside their area. With regard to the system of distribution there is little change; three-wire direct-current at about 220 and 440 volts continues to hold sway. One more concern has abandoned the old time single-phase system with transformers in favor of the direct-current system. With regard to generating plant, the increasing use of the steam turbine especially for alternators of large size is very noticeable. A few more engineers have installed gas driven plants, but only in connection with small units. There is an almost universal reduction in the price paid for coal, which is partly due to the further perfection of automatic stoking appliances which enable the use of cheaper qualities of coal. The steady reduction in the price charged for lighting supply has continued, but the decreased charge is more marked in the case of supply for power and heating. A number of the London companies, for example, now supply energy for this purpose at two cents per kw-hour. Notwithstanding the keenness of the competition of gas lighting, the increase in electric street lighting is well maintained and numerous Nernst lamps have been installed during the year. The new metallic-filament lamps are beginning to make their appearance in the streets, and in several places the flame arc has been introduced.—Lond. *Elec.*, January 12.

Automatic Control of Large Motors.—JAMES.—A fully illustrated description of an automatic reversing controller recently designed for the handling of a 900-hp, direct-current compound motor. The controller proper is operated by compressed air. The valves to the air cylinders are controlled by electromagnets supplied with current from a separate low-voltage circuit. Each valve is held by a spring in the position which cuts off the air pressure from the cylinder and connects it with the exhaust. When the magnet is energized the exhaust is closed and air is admitted to the cylinder. Thus the force of the air compresses a heavy spring and closes the circuit-breaker, or in the case of the reverser, rotates it in the opposite direction. The construction is described in detail and the advantages of the electropneumatic system of control for large motors are pointed out. "A pressure of several hundred pounds is available for closing the contacts of the current-breaker which permits the use of a powerful spring for opening the breaker, thus causing a quick break of the arc, which reduces the burning and prevents the breaker from sticking. The air valves can be controlled by very small magnets wound for low voltage. This materially reduces the liability to trouble with these circuits and there is practically no burning on the contacts of the master-switch interlocks. The power required to operate these valves is so small that the pilot wires need be only large enough for mechanical strength. This low-voltage circuit can also be used for signal purposes when the master switch is located at a distance from the machine. A strong point in favor of this system is the facility with which friction brakes and mechanical clutches can be operated and controlled with compressed air by using the same magnets and valves which are used on the circuit-breaker. The pressure of the brake or clutch can be varied through wide limits by manipulating the control valve."—*Elec. Jour.*, January.

Switch Gear.—WHITCHER.—A paper read before the Rugby Engineering Society giving some notes on heavy electric switch gear. The author discusses the special features of the following three classes: The plug type, the lever type and the bridge type. He then takes up the question of arcing tips and carbon brake attachments to switches and circuit-breakers and discusses the reasons for the superiority of the carbon brake over the metallic brake.—Lond. *Elec.*, January 5.

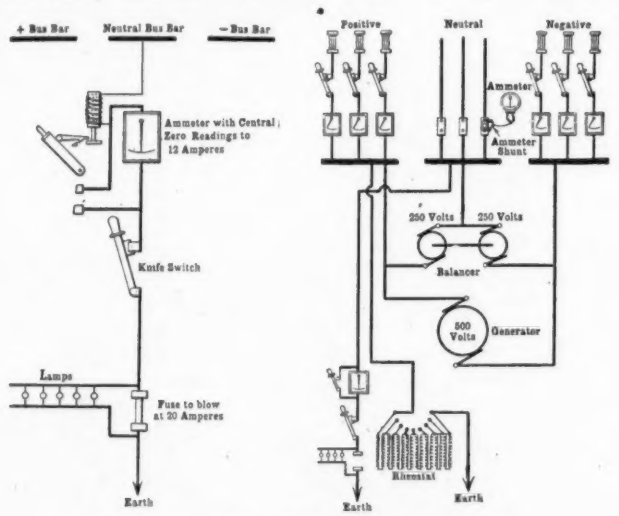
Electropneumatic Controller.—MONTPELLIER.—An illustrated description of the Bouscot electropneumatic controller for operating from a distance the air compressors on tramway cars; it is also specially adapted for controlling electric motors driving pumps. —*L'Elec.*, January 6.

Insulating Material.—A note on a new fireproof insulating material of the Allgem. Elek. Ges. Layers of a fireproof material, like asbestos, are strongly pressed on both surfaces of plates of a good insulating material, "like vulcan asbestos or tenacite." Such a strong pressure is applied that there is produced a gradual transition from the fireproof to the highly insulating material and the resulting plate is one unit. Each plate consists, therfore, of a highly insulating core with fireproof surfaces.—*Elek. Zeit.*, December 21.

Wires, Wiring and Conduits.

Underground Mains.—BLACK.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Engs. In the first part the author gives a review of the layout of the cable system in Glasgow and its maintenance. The high-tension mains are three-core cables, paper-insulated, lead-covered and armored; for the most part they have been drawn into earthenware ducts laid in concrete. The low-tension feeders consist of triple concentric cables, each of 1x1x0.3 sq. in., the smaller sectional area being that of the neutral conductor. Some have impregnated jute or paper insulation with a lead sheathing and others have paper insulation with vulcanized bitumen sheathing. All of these are laid on a solid system in either cast-iron, earthenware or im-

pregnated wooden troughing. Most of the distributing network also consists of triple concentric cables of the same type. After experience with the above cables and troughing for low-tension work, the paper-insulated, bitumen-sheathed cable, laid in wooden troughing filled in with pitch, has been adopted as the standard. The bitumen-sheathing obviates the likelihood of electrolysis of a metallic sheathing, and, what is perhaps more important, leaves no chance for the trouble experienced when the sheathing of lead has become alive owing to a fault, and has caused arcing at a point perhaps far distant where the lead has been in accidental contact with earth. Wooden troughing is cheap and is likely to have as long a life as thin cast-iron troughing. Refined bitumen is no longer used as a filling, since good pitch mixed with a suitable amount of pitch oil has proven satisfactory. The feeders terminate at the distributing end in large cast-iron underground chambers, to which are brought the whole of the distributing cables for the various streets in the neighborhood of the feeding point. The feeder is connected directly without fuses to three main bus-bars and the distributors are connected through fuses to the positive and negative bars, and directly without fuses to the neutral bar. As a rule, eight or ten distributors radiate from each feeding point. They have no connection with one another nor with any distributor connected to any other feeding point. This arrangement conduces to the general safety of supply, and in case of trouble lends itself to a less costly and more scientific system of fault localization.



FIGS. 2 AND 3.—UNDERGROUND MAINS.

During the last years a considerable number of section pillars have been erected instead of underground manholes. These pillars have the advantage of being somewhat cheaper in first cost and involving a minimum of disturbance to the street during erection and are drier than underground boxes. Fig. 2 illustrates an arrangement on the low-tension mains which has been devised to meet as far as posible, any contingency arising in respect to an earth coming on either the positive or negative side of the network. In case of such a contingency the ammeter will immediately indicate the faulty side of the system. If the leakage current is less than 12 amperes, the only indication of the disturbance is on the scale of the ammeter. If the current, however, exceeds 12 amperes, the ammeter will be short-circuited, since a solenoid-operated switch in shunt with it is closed; and if the current exceeds 20 amperes, the fuse will be blown and a bank of incandescent lamps in shunt with the fuse will light up so as to draw immediate attention to the fault, and it now becomes necessary to locate the district in which it has occurred. The knife switch is opened and a new fuse inserted and with a longer handle fixed in the knife switch the neutral conductor is flashed to earth by quickly closing and opening the switch. At the same time the feeder ammeters are watched and the fault will be on the feeder or a section of the network attached to the feeder whose ammeter shows a sudden rise in current at the instant the neutral bus-bar is earthed. The neutral conductor being normally at earth potential and therefore not under test, it becomes necessary to ascertain that its insulation resistance is not deteriorating. The arrangement used for this purpose is shown in Fig. 3. A central-zero ammeter, or an ammeter shunt capable of carrying, say, 500 amperes, is connected permanently between the neutral bus-bar in the station and the neutral conductor of each feeder leaving it. A reading of the out-of-balance current (amount and direction) on each feeder is taken and noted. The positive or negative bus-bar is then gradually earthed through a resistance which it cut out step by step until a fairly large current is passing through it. A second set of readings is now taken of the out-of-balance current on the various feeders, and is compared with the first set taken. The difference in the reading is the amount of current passing through any weak spot on the neutral conductor and earth. This test is taken about once a week and has been the means of discovering in Glasgow several cases of mechanical damage to cables. It is specially useful where the outer or neutral conductor only of a triple concentric main has been injured since the warning provided gives an opportunity for having repairs effected before moisture gets in and causes a short-circuit between the outer and inner conductors.—Lond. *Elec.*, January 12.

Electrophysics and Magnetism.

Hysteresis Loss in Alloyed Sheet Iron.—Benischke.—Steel manufacturers have succeeded during the last ten years in reducing the coefficient of hysteresis from 0.002 to 0.001. In order to reduce the eddy currents, special alloys have been introduced into practice which have a very high specific resistance, but the same low hysteresis loss as the usual iron. Such alloys can be made having an eddy-current coefficient about one-third that of the usual iron, while the hysteresis loss is also smaller. This is called in Germany "alloyed sheet iron" (legiertes Eisenblech). The temperature coefficient of the resistance is about one-third of the ordinary value, being 0.0008 to 0.0016 against 0.0047 for ordinary iron. The total loss (hysteresis plus eddy current) for one period is in this case exactly represented by the formula $\eta \mathfrak{B}^{1.6} + \beta v \mathfrak{B}^2$. If this value is plotted in the diagram as function of the frequency, v, a straight line is obtained while with ordinary iron this curve is slightly bent. The author used such iron alloy for determining the influence of the wave shape on the hysteresis loss and found that for the same maximum value of the magnetic flux the hysteresis loss is the smaller the more pointed the form of the magnetic wave.—*Elek. Zeit.*, January 4.

Spark Potential and Gas Pressure.—C. E. and H. Guye.—A paper read before the Congress for radiology and ionization in Liege on spark discharges through gases. The experiments were made with nitrogen, oxygen, hydrogen and carbonic acid. The gases were carefully cleaned and dried. Up to about 10 atmospheres the spark potential increases as a linear function of the pressure. If the pressure is further increased the ratio of the spark potential to the pressure decreases. The curves representing the spark potential as function of the pressure are parabolic. In all experiments with nitrogen the curve of the spark potential has a maximum near the maximum of the compressibility of the gas (pv = minimum). A few experiments made with carbon dioxide near the critical point appear to indicate a decrease of the spark potential at that point.—*Phys. Zeit.*, January 15.

Thermo-Electricity.—Lecher.—A note discussing the coincidence of the zero point of the Peltier effect and of the maximum of the thermo-electric force.—*Phys. Zeit.*, January 15.

Units, Measurements and Instruments.

Testing Meters in Situ.—Gerhardi.—In a continuation of his illustrated serial on electricity meters the author discusses the methods of testing meters in situ. Fig. 4 shows the connections for the test of a watt-hour meter in situ using the consumers' lamps as load. The dotted lines indicate the temporary connections. The shunt circuit of the watt-meter is isolated from the main coil and the latter is inserted on the "house" side of the meter under test. The leads from the wattmeter shunt terminals are connected to the supply main terminal and shunt terminal of the meter respectively. If a portable lamp box is used as resistance, the connections are as shown in Fig. 5. The house lead, *A*,

is removed from the house terminal of the meter as before, and if connected to the station terminal by a lead, *B*, the test can be made without interrupting the supply. With the connections

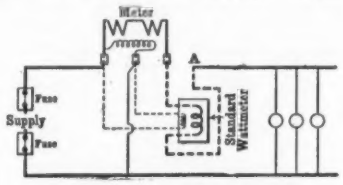


FIG. 4.—TESTING METER.

shown the current passing through the portable lamps passes through the shunt. For large loads this would not be safe but up to about 10 amperes, no harm will be done. Testing in situ, if done properly, also becomes a check on the wiring of the house. It is very often difficult to trace wiring (especially additions),

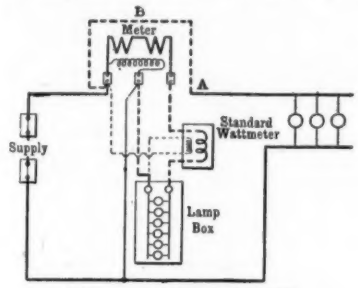


FIG. 5.—TESTING METER.

and it sometimes occurs that a lamp or lamps may be connected on the station side of the meter. The tester should, therefore, always be on the lookout for such unmetered circuits, which are easily found out by leaving the end, *A*, out of the meter and trying to turn on suspected lamps, which, of course, would only glow if connected to the wrong side of the meter. Fig. 6 shows

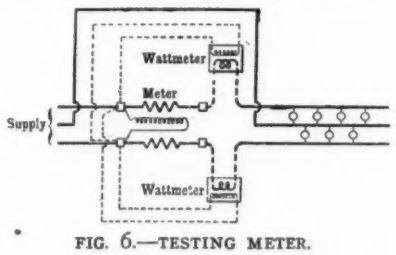


FIG. 6.—TESTING METER.

the connections for the test of a three-wire watt-hour meter in situ, using two wattmeters, and applying a constant of 0.5 to obtain the true power if their shunt currents are normal.—Lond. *Elec.*, January 5.

BOOK REVIEWS.

TRAITE PRATIQUE D'ELECTROCHEMIE. By Richard Lorenz. Paris: Gauthier-Villars. 323 pages, 77 illus. Price, 9 francs.

This work is an expansion of the well-known "Elektrochemisches Prakticum" of Lorenz. Mr. Georges Histelet has recast the work into French, putting it into the shape of a text-book of electrochemistry, and introducing the experiments at appropriate places to illustrate the principles in the text. A few extracts from the preface will explain this plan:

"We propose to unite a means of practical education with a progressive method of instruction in the laboratory, as much to make felt the spirit of electrochemical theories as to teach how to use them as guides in experimental work."

"The book is divided into three parts. The first studies in an elementary way the fundamental laws and reactions of electrochemistry proper, using the simplest experimental demonstrations; the second treats exclusively of the electrolysis of aqueous solutions, in such manner as to show how, by the aid of physico-chemical theories, one can measure the physical data met with; the third is concerned with applied electrochemistry, and constitutes a study of the preceding principles as applied to practical problems."

The plan of the book is in many ways commendable, as uniting laboratory tests with theoretical discussions; and since the combination is very carefully and judiciously done, the teacher or independent student will find in it a very helpful guide to an intimate knowledge of the principles and theories of electrochemistry.

STEAM TURBINES, WITH AN APPENDIX ON GAS TURBINES AND THE FUTURE OF HEAT ENGINES. By Dr. A. Stodola. New York: D. Van Nostrand & Co. 434 pages, 241 ills. Price, $4.50.

Prof. Stodola's work on the theory and design of steam turbines is admittedly the best that has been issued to date, and it is gratifying to have an English translation thereof as satisfactory as that prepared by Dr. Loewenstein. Primarily the volume is of interest to turbine builders alone, as the critical analysis of the various factors entering into the design of such machines is carried somewhat beyond the limits within which the average engineer would feel it desirable or needful to be at home for the purpose of intelligently handling the routine problems which he is apt to encounter. No one, however, objects to having a standard reference volume on which to fall back in times of need, and Stodola's book is undeniably entitled to admission in that category.

The principal sections of the work in the order laid down by the author comprise, first, the elementary theory of the steam turbine; second, the theory considered thermodynamically; third, the design of the most important parts of such machines; fourth, a description of typical steam turbine forms; fifth, some of the special problems in theory and construction; and finally, a brief appendix on the future of the heat engine.

The first section seems to have been written as a general introductory exposition of the theory of the steam turbine for the benefit of those engineers who have not had occasion or opportunity to keep in touch with the rapid development of these machines. It is brief, extending over but 42 pages, and is chiefly devoted to the classification of possible variants into different groups and types and an analysis of the characteristics of each. The second section on the thermodynamic theory of the turbine and the laws of energy therein is valuable for its combination of theoretical mathematical deductions with the extensive series of experimental investigations carried on by the author and others on the flow of steam through nozzles and the frictional resistance of rotating discs in and steam from which are derived various formulæ and constants essential to the intelligent design of turbines.

The third part of the volume, that is, the one on the construction of the more important turbine parts is formed, as might be anticipated, of sections on such subjects as the proper form of blade profiles, methods of securing blades to wheels, disc designs and permissible peripheral velocities, shaft and bearing designs, balancing problems, governing means and the like; in other words, the data requisite in turbine design as distinguished from that found in the numerous authorities on ordinary machine design. Part four is largely descriptive, giving illustrations and more or less detailed reproductions of drawings of parts of the various forms of commercial turbines. Aside from the general value of the author's criticisms of the relative advantages and disadvantages of the types, the matter of chief importance is the series of full and carefully tabulated results of experiments on the Rateau and Parsons machines and the effect of varying loads, superheats and vacua on efficiency.

The fifth section on special problems of theory and construction is rather technical and the average engineer who is simply desirous of posting himself in a general way on turbine apparatus and does not contemplate qualifying as a designer will probably content himself with rather a hasty glance through the sometimes involved matter. The sub-headings treat of such things as the distribution of pressures in the cross section of an expanding jet, the stresses in wheels due to uniform heating, velocity caused by the deflection of a uniform shaft due to its own weight, the differential equation for pressure distribution in many staged turbines, etc.

The appendix is a short analysis of the various expedients that have been proposed to date for attaining increased efficiency of conversion of heat into mechanical energy not alone in steam turbines but steam and gas engines and these in combination with turbines. The gas turbine, too, is treated of and the calculations of such devices both graphically and mathematically and with and without the injection of water are given, all however merely as a matter of interest and not of present utility as the author states that only when the mechanical efficiency of gas compression becomes of very high value and when means have been devised of considerably increasing the efficiency of the flow energy in turbines or when substances of sufficient stability and strength at temperatures beyond red heat have been found, will the gas turbine become a commercial factor. In this section there is also a summary of a communication that the author received from Prof. Lorenz setting forth the present status of the efforts that have been made to obtain electricity direct from coal and showing that there is no immediate prospect of success in that direction.

The translator has left all formulas, which in the original were expressed in metric units, as they stood, but given in addition thereto their conversion into the English system. The large steam table curve sheets are also supplied with the book in both units. It is merely to be hoped that the necessity for translating metric language into our barbarous English jargon will before long be rendered unnecessary by favorable action of Congress on one or more of the metric bills now before it.

On the "Reducing" of the Fire Hazards of a Motor Circuit.

By D. J. Burns.

A motor circuit, unless properly protected, presents one of the worst electrical fire risks in existence. It frequently occurs that a motor is installed anywhere that is convenient regardless of the "exposure" risk it will present and is operated by any one regardless of his capability. A motor is strongly built and is not, in itself, a bad risk when running under its proper condition of load and speed, yet it becomes an extremely bad hazard when the motor starting rheostat is improperly constructed or operated.

Great stress should be laid on the requirements of motor starters. The fact is that while even a badly designed or poorly built motor may be run for years if controlled by a good starting rheostat, a bad starting rheostat will cause a breakdown of the best equipment, unless the utmost care be exercised.

The function of a motor starter is, firstly, to insert resistance in the armature circuit of a motor in order to keep the starting current below a certain predetermined maximum; and, secondly, to gradually cut out this resistance, thus gradually increasing the voltage at the terminals of the motor armature and correspondingly decreasing the volts upon the starting rheostat until the full volts are applied to the motor armature and it is operating at full speed.

Consider what will happen if an ignorant, careless or vicious operator starts a motor by cutting out the starting resistance more rapidly than the counter volts of the motor build up. Take a 5-hp, 250-volt, shunt-wound motor, armature resistance .4 ohm motor armature at rest, starting lever moved over the starting contacts in one or two seconds; the motor armature does not have time to move from its position of rest and begin to accelerate and generate counter volts; therefore, this 4/10 of an ohm is directly across 250 volts and, theoretically, 625 amp. (approximately) will pass through the motor armature. This means terrific sparking and sputtering and, if frequently repeated, final destruction. This sputtering and sparking and final destruction are each bad fire risks.

Therefore, the first requirement of the operation of a motor starter in order that the motor will not present a fire risk is that the resistance of the starter be cut out at a proper rate to suit the rise of the voltage at the terminals of the motor. A greater starting current is required when the motor is started under load than is necessary with light load, and the starting arm can be moved faster to cut out resistance for light loads than it can be for heavy loads.

The proper method of accomplishing correct starting is to have in the motor circuit a protective feature which will open the circuit *instantaneously* upon the passage of a predetermined amount of current. A circuit-breaker is the best commercial device to use for this protection. It acts instantly, preventing a too rapid movement of the rheostat lever—and in performing its function it does not destroy or even damage itself.

The Underwriters' quarterly reports of fires show that a large number of fires are due to excessive sparking at the motor commutator, which is caused by successive improper starting.

It is well known to engineers and motor manufacturers that most of the damage which comes to the motor circuit is due to excessive current put through the apparatus in starting the motor or attempting to start it. While the motor is at rest the brushes may have been shifted, the fields weakened, the load upon the motor may have been changed or the type of load may have been changed, the shafting disarranged or a wrench left in the gears of the machine, or a tool set for a too deep cut, or any of the numerous causes which might prevent a motor armature from starting or cause it to start under extreme overloads. An independent circuit-breaker offers a perfect protection if the operator attempts to start the motor under such conditions.

The first requisite of a starter, in order that the motor will not present a fire risk, is that the device which is to open the circuit upon overload shall be able to act during the period of starting the motor, as well as when the motor is running under full speed conditions. It should be borne in mind that in most cases the operators of motor starters are people not technically acquainted with electrical matters, and hence do not know what is necessary in order to properly start a motor and do not know what a bad fire hazard an overloaded motor presents.

The second important requirement of a motor starter, in order that the motor shall not present a fire risk, is that the circuit breaker shall be so mechanically interlocked with the motor starting lever that the circuit-breaker cannot be closed except by moving the starting lever to the open circuit position, thus making it impossible to close the circuit breaker so as to make a short circuit or overload.

The total resistance of the best makes of commercial starters is such that 1½ times the full torque current of the motor will flow when the starting lever is moved to "make" the circuit. (It takes 1½ times the full torque current of a fully loaded motor to start it against the friction of rest and to accelerate it in a reasonably short time to full speed.) So a circuit breaker must be set somewhere above 50 per cent overload and because motors really are started rapidly and, at times, under condition of overload, the circuit breaker is nearly always set at 100 per cent overload, i. e. twice the full load normal current.

A 100 per cent overload is a safe overload for a motor armature during the usual interval required for starting the motor, but a current less than that which is required to operate a circuit breaker set to open at twice the full load current would burn out a motor armature if maintained for an improper length of time. Therefore, there should be in the circuit a device set to operate at about 50 per cent overload, having a sufficiently long time limit in its operation to prevent its acting during the period required for properly starting the motor.

An enclosed fuse fulfills this requirement very well; as an example: It is stated that "an enclosed fuse of the 30-ampere class is designed to operate in about 30 seconds when overloaded 50 per cent."

It is necessary to have a fuse on both sides of a motor circuit; otherwise one side being grounded in one place, and the other side in another place, there might be established a circuit with no fuse in action at all.

For the proper protection of the circuit during the periods other than starting of the motor, two fuses are necessary, one in each pole of the circuit. For the proper protection of the circuit during the period of starting the motor, a circuit-breaker is necessary; which may be single-pole, provided it is so interlocked with the starter that the circuit cannot be closed on short circuit or improper overload.

COMPARATIVE VALUES OF CIRCUIT BREAKERS AND FUSES IN REDUCING FIRE HAZARDS OF A MOTOR CIRCUIT.

A circuit breaker acts quickly enough to protect the motor against overloads during the period of starting and in performing its function does not destroy itself. A fuse is not designed to act quickly enough to offer protection while a motor is being started rapidly and in operation does destroy itself. A fuse (when not supplemented by a circuit breaker) is a bad risk, because when a fuse blows it is frequently replaced by one of a higher capacity or by a piece of copper wire. It is not only the ignorant who will do such bad work, for it is done by any hasty man who does not happen to have extra fuses at hand. A circuit breaker set at 100 per cent overload will always operate quickly enough to prevent the blowing of a fuse rated at 50 per cent overload. A circuit breaker is far more reliable than a fuse.

If a reliable automatic device such as a circuit breaker can be readily arranged for the protection of a motor circuit, it is accepting an unnecessary risk to depend entirely upon the unreliable fuse or upon the intelligence of a careless, ignorant or vicious operator, or to assume that every plant has a proper assortment of first-class fuses and that technically skilled and conscientious workmen will always be available to replace a burned out fuse.

FIRE HAZARD IN STARTING RHEOSTATS.

In starting a motor all of the current carrying parts of the motor rheostat tend to heat up, due to the passage of current through them.

All "open or exposed" resistance types of motor starters present a very serious fire risk. In such types the resistance is wound on bobbins or tubes of so-called "asbestos" board, which contains a large percentage of combustible material. The asbestos board will absorb moisture, producing electric action and also tend to cause a ground on the rheostat frame. The coiled wire wound around the tube is under tension, and when burned out, will become loose and move about, short-circuiting other coils and causing arcing and spitting of molten metal from the rheostat. Asbestos board will ignite when heated by the resistance wire and flames will issue from the rheostat—*there will actually be a blazing fire in the rheostat.* If the lead wires from the resistance to the face contacts are soldered, then molten solder will fall from the rheostat, even before the rheostat burns out. If the rheostat is mounted where filings or inflammable material might get in contact with the heated resistance wire, such materials will produce a bad fire risk.

With such starting rheostats, it is necessary to enclose them in fireproof material, if it is desired that they shall not present a fire risk.

"Enclosed resistance" types of starting rheostats of proper design are constructed, however, with the resistance so entirely enclosed that if the resistive conductor be fused by excessive current or otherwise, the arc is quickly and quietly extinguished, without any attendant fire risk. Among such types can be cited the packed card type, the packed mica and iron type and those types in which the resistance material is imbedded in sand or in cement, enamel, glass, slate, etc.

If a reliable enclosed resistance can be readily obtained that will not present any fire risk whatever, then it is running an unnecessary risk to depend upon the good intentions or the intelligence of a "user" to build a fireproof cabinet for the open type rheostats, in order that they will be safe to use.

FIRE HAZARD OF FACE PLATES OF MOTOR STARTERS.

The fire hazard presented by a face plate of a motor starter consists in the arcing between the movable and fixed contacts (neglecting for the present any arcing which might occur upon the opening of a circuit breaker mounted upon the rheostat). The greatest amount of arcing occurs upon breaking the circuit on the starting contacts.

A great deal of attention has been given in the past to the main line motor switch and but very little to the starter switch. It should be remembered that in starting a motor, the circuit breaker is first closed, then the line switch is closed and then the circuit is really completed by the starting lever making contact with the initial live stationary contact. It is seldom that arcing occurs on the main line switch for it is closed when the circuit is open on the starter and is opened when the motor is developing protective counter volts.

The starting lever and the starting contacts are the elements of a single pole switch, which is closed and opened at the initial live contact and a great amount of arcing will occur at this point, for this switch is closed when the motor armature is at rest, and it may be opened before the motor armature starts to move or when it is just beginning to move. Since the total resistance of the best makes of commercial starter is such that one and one-half times the full torque amperes will flow through the rheostat and motor upon closing this switch, then with a 5-hp, 250-volt starter, the arc caused upon breaking the circuit will be due to 30 amperes at 250 volts or 7,500 watts. (Under normal conditions.)

An ignorant, careless or vicious operator will often move the starting lever to the initial live contact and withdraw it *slowly*, opening the circuit slowly, and an arc due to 7,500 watts will be maintained for a sufficient length of time to cause (1st) a fire, if inflammable materials are in free circulation; (2nd) the burning of the sliding contact, which will cause arcing on each of the stationary contacts when they are next in service.

This fire hazard can be reduced to a minimum by "making" the circuit at a point which is entirely independent of the movable contact and the arc of the stationary contacts and by "breaking" the circuit at this point with a quick snap, independently of the slowness of movement of the operator's hand. When necessary this auxiliary quick break should be supplemented by a magnetic blow out in order that the arc should be effectively extinguished.

The fire hazard presented by the stationary contacts and the movable contact on the motor-starting arm can be reduced to a minimum by having the "stationary contacts" made of renewable segments and the "movable contact" made of self-aligning renewable skate shoes, sufficiently flexible to ride over any projection raised 1/16 in. above the contact surfaces.

If the simple and plain requirements as outlined in this article are followed the "fire hazard" in a starting rheostat will be reduced to a minimum.

A Continuous Steam Engine Indicator.

The demand for a steam engine indicator which will show at all times the indicated horse-power developed by an engine

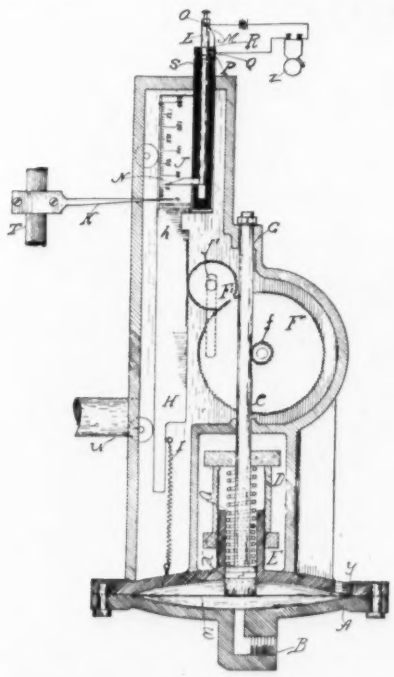
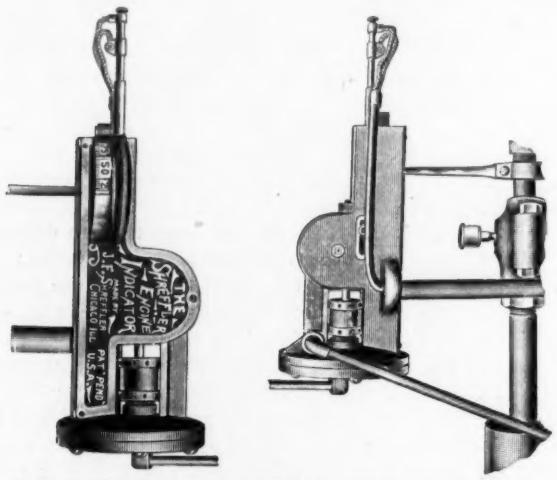


FIG. 1.—CONTINUOUS INDICATOR.

without regard to the variations of steam and exhaust pressure has been developed by Mr. John F. Shreffler, 376 S. Campbell Avenue, Chicago, who has placed the device on the market. The principle of this device is very simple. The indicating fin-

ger, *K*, Fig. 1, is attached to a part of the engine, the movement of which varies according to the load, this part being the governor rod on a Corliss engine and the valve stem on a high speed automatic cut-off or marine engine. The indications of the finger, *K*, are read from the scale *h*. The position of this scale depends on the difference between the initial and back pressure on the engine. The movement of this scale to accomplish this is by means of a multiplying gear connected to a rack and pinion, this rack being moved by a diaphragm on one side of which the



FIGS. 2 AND 3.—FRONT AND REAR VIEWS OF INDICATOR.

exhaust pressure is admitted and on the other side of which the initial steam pressure is admitted. The position of the diaphragm and therefore of the scale is dependent on effective initial pressure. Fig. 2 is a front view of the device and Fig. 3 the rear view. The device is calibrated after it is placed on the engine by means of the ordinary steam engine indicator after

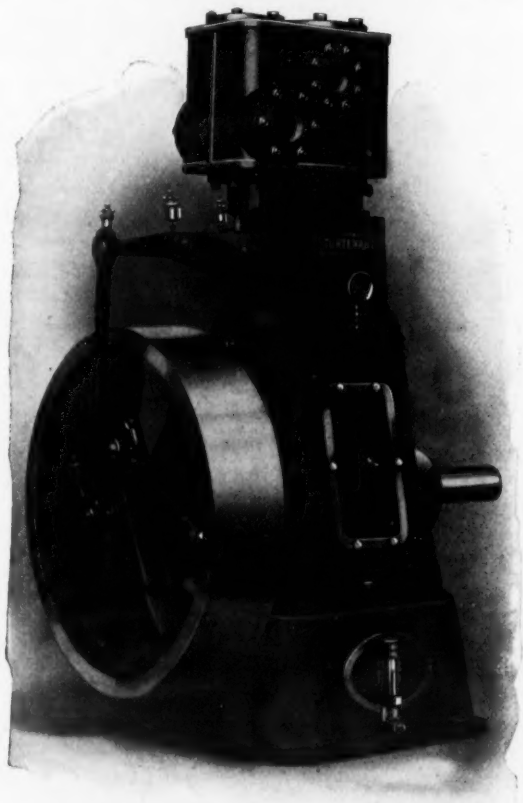


FIG. 1.—HIGH-SPEED ENGINE.

which the scale is marked to read directly in horse-power. In addition to its purpose as an indicating instrument, it may also be used to give an overload alarm by placing an electrical contact on the scale so that the index finger will strike it upon the predetermined overload for which it is set.

Pure Copper Trolley Wheels.

In order to overcome the difficulties found in trolley wheels made of alloyed copper, the H. W. Johns-Manville Company,

TROLLEY WHEEL.

100 William Street, New York, has developed a wheel made of absolutely pure copper, which is purified, and then strengthened by a special process. These wheels are furnished with bushings of a metal whose tenacity is equal to that of steel, and whose ductility and toughness are such that it will not crack when distorted by a load of 130,000 lb. per sq. in.

High-Speed Vertical Engines

The engine shown in the accompanying illustrations has been especially designed for the driving of direct-connected generators, and in the proportioning of its parts a special effort has been made to obtain the maximum of power in the minimum of space. One of the most striking features of the engine is the system of forced lubrication combined with the complete enclosure of the moving parts.

Within the heavy cast-iron base is placed a submerged oil pump which, being operated by the crank shaft, draws oil from the reservoir and forces it through pipes and internal passages in the moving parts to the crank pin, the wrist pin, and the main bearings. Twice during each revolution the reversal of stress on these parts, due to the double acting feature of the engine, so reduces the pressure that the pump has an excellent opportunity

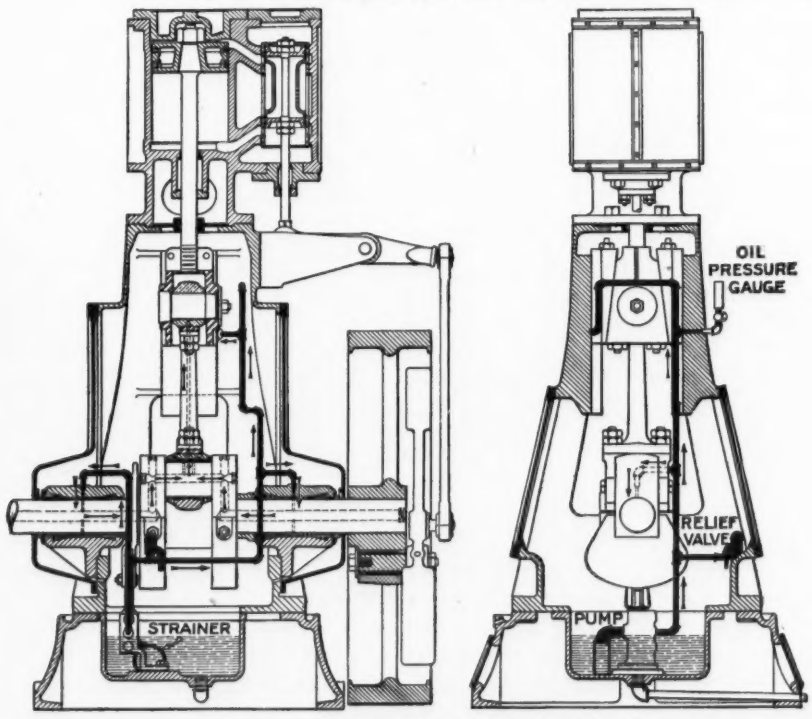


FIG. 2.—SYSTEM OF FORCED LUBRICATION.

to force between the surfaces a fresh film of oil which is carried around to lubricate the rotating parts when the pressure is greater.

These engines are built by the B. F. Sturtevant Company, Hyde Park, Mass.

Sewing Machine Motor.

In the sewing machine motor is to be found an interesting application of electric power for small machines. The motor illustrated herewith is combined with a transmitter, brake and switch on a single supporting bracket which may be attached to any style of table for use with every variety of sewing machines.

The transmitter consists of a friction device and levers giving speed control by purely mechanical means, which replaces the usual speed-regulating rheostat. Pressure on the treadle operates a lever which closes the switch and starts the motor. Further pressure moves the loose wheel along the shaft and engages the tight wheel, and the degree of pressure regulates the friction between the wheels and therefore determines the speed of the driving pulley. When the treadle is released a spring attached to the lever disengages the friction wheels, opens the switch and applies the brake.

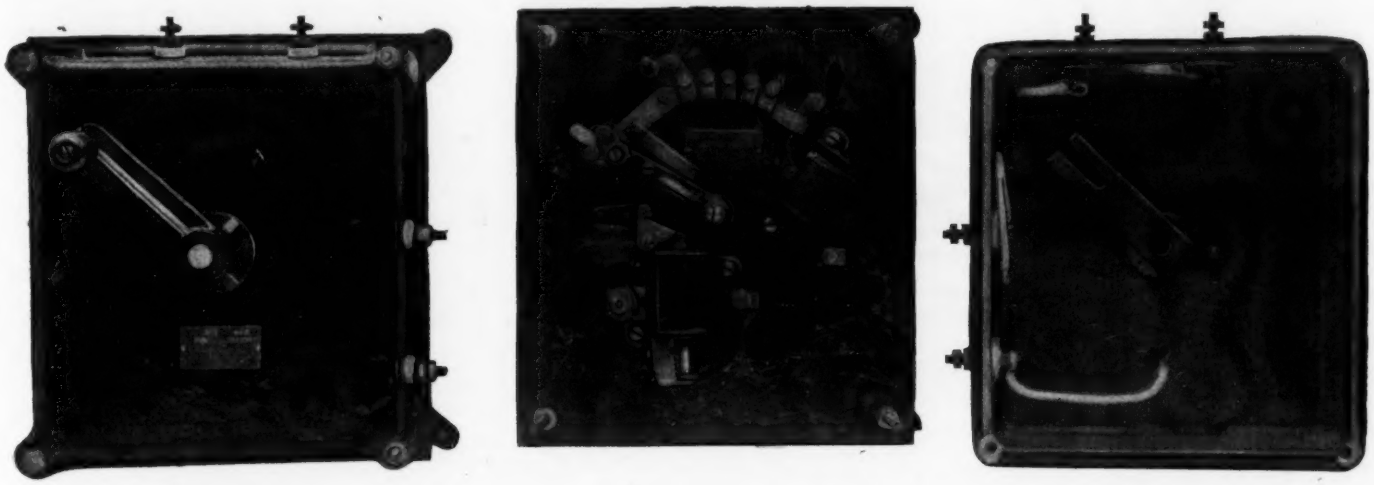
The motor being started without load, requires no starting resistance, and it attains full speed instantly. As a consequence the treadle may be pressed down to its limit in one movement and the machinery rapidly reaches its full speed. This equipment is built by the Diehl Manufacturing Company, Elizabethport, N. J.

MOTOR-DRIVEN SEWING MACHINE.

Enclosed Motor Starter.

At the annual meeting of the Underwriters' National Electrical Association held on December 6, the following was added to the National Electric Code, the changes to appear in the 1907 issue of the Code or in the April supplement:

"Rule 8, Section D, fine print note: Starting rheostats and auto-starters unless equipped with tight casings enclosing all current-carrying parts, should be treated about the same as knife switches, and in all wet, dusty or linty places, should be enclosed in dust-tight, fireproof cabinets. If a special motor room is provided, the starting apparatus and safety devices should be included within it. Where there is any liability of short-circuits across their exposed live parts being caused by accidental contacts, they should either be enclosed in cabinets or else a railing should be erected around them to keep unauthorized persons away from their immediate vicinity."



FIGS. 1, 2 AND 3.—ENCLOSED MOTOR STARTER.

The cut herewith shows a motor-starter equipped with a tight case enclosing all current-carrying parts, which has been designed by the Ward Leonard Electric Company to fulfill these requirements. The rheostat controlling lever does not carry current, nor is it alive. Other special features of this box, such as the enclosed resistance, independent make and quick-break switch, etc., have previously been described.

American Vibrator Machine.

Vibratory massage has now come to be accepted by the medical profession as a valuable aid in curing certain disorders and improving circulation. The demand for machines to give such vibratory massage has heretofore been mainly met by large motors. This has even necessitated the use of a stationary motor with a flexible shaft for transmitting the power or a motor which is too heavy for convenient portable use. The American Vibrator Company, 910 Commercial Building, St. Louis, Mo., has just placed on the market a vibrator the motor of which is so small that it can be used directly on the work. This is accomplished by making the motor very light, placing on one end of the shaft an eccentric for producing vibration of the motor itself and placing a spring handle between the motor and the operator.

The complete outfit is shown in Fig. 1. The handle in the latest outfits is made of sponge rubber, and between the handle and the motor is a flexible spring for deadening the vibration of the handle. The motor itself is in an aluminum case. The fields are of laminated iron punchings, which surround the armature completely, the armature being removed from one end. The various appliances used in massage are secured directly into a receptacle mounted on one end of the motor. These appliances do not revolve, as might be thought from an inspection of the engraving. The only motion of the massage appliance is that of

vibration. The only exposed part revolving is the eccentric on the upper end of the armature shaft. This eccentric can be adjusted to a greater or less degree of eccentricity, thus producing a large or small vibration, as desired.

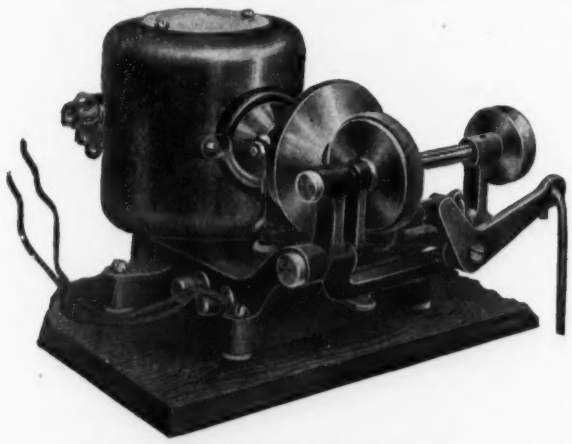
The whole appliance, to be held in the hand of the operator, weighs less than 2¼ pounds. A regular series commutator motor is used both for direct and alternating currents. The direct-current motor is said to consume about .2 amp., so that it requires only about 22 watts to operate it. Vibratory massage is used not only by physicians, but by barbers and by private individuals. A

VIBRATOR MACHINE.

device of this kind makes a valuable addition to the list of electrical luxuries that central station service puts within the reach of its customers. A small vibratory device of this kind will no doubt be purchased and used by many central station customers who would not think of buying some of the larger equipments used by professional physicians and masseurs, and for that reason it will be welcomed by the central station man striving to increase his output.

Sewing Machine Motor Outfit.

By means of the sewing machine outfit, which forms the subject of the accompanying illustration, and which is known as the "Paragon transmitter," there is obtained at all times a positive drive giving a speed variation ranging from a few stitches per minute up to the maximum. As will be noted, a light rod connects the operating switch with the treadle of the machine.



SEWING MACHINE TRANSMITTER.

Gentle pressure on the treadle opens the switch and starts the machine, and further depression gradually increases the speed of the machine, as desired. This transmitter outfit complete is built by the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass.

Additional Notes on the Chicago Electrical Show.

In last week's issue of the Electrical World appeared a large number of notes on the Electrical Show then in progress in Chicago, and the subject is returned to in the items given below as to some features left for later treatment. The interest manifested by the general public in this show, as shown by the large attendance, has been remarkable, and has surprised even the most enthusiastic promoters. Plans are already on foot for a similar exhibition next year. It has not only attracted the general public, but electrical men from all the surrounding territory who have been planning trips to Chicago during the winter have made it a point as far as possible to come in during the two weeks of the show. For this reason it has been a good advertising proposition for the exhibitors as well as a financial success as far as the exposition company is concerned. A very pleasant feature of the show was the concert every afternoon and evening by Weil's Band. A better band could hardly have been secured. As the galleries were not occupied by exhibits, it was always possible to escape the crowd in the aisles and find seats in the gallery where the excellent concert could be enjoyed. On account of the great crowd every evening this was a feature much appreciated by the public.

The Hofbrau restaurant in the Annex proved a great convenience during the show. It also demonstrated the feasibility of electric cooking on a large scale, the kitchen being equipped with electric utensils.

The last week of the show part of the general illumination was accomplished with the Siemens' flaming arcs, which, placed high up in the center of the building, had a good opportunity to demonstrate their downward illuminating properties. This arc lamp was described in the January 6 issue.

Among the numerous visitors attracted from surrounding states were Austin Burt, of Waterloo, president of the Iowa Electrical Association, and L. D. Mathes, of Dubuque, of the executive committee of that association. Plans are well formulated for the programme of that association's next convention which will be held at Des Moines in April.

C. H. Thorardson gave frequent demonstrations with his high potential transformer followed by a series of experiments on the fundamental principles of alternating-current apparatus. These experiments were fascinating even to electrical men who had been familiar with the principles involved for years. Mr. Thorardson's demonstrations never failed to pack the aisles in that end of the building, and were beyond doubt the greatest single drawing card in the exhibition.

A meeting of the executive and insurance committee of the Illinois State Electrical Association was held at the Great Northern Hotel, Chicago, January 23, the second week of the show. Those present were Mr. D. Davis, of Litchfield, president; Mr. H. E. Chubbuck, of La Salle, secretary; Mr. E. G. Schmidt, of Springfield; Mr. F. J. Baker, of Chicago; Mr. S. S. Davis, of Rock Island, and Mr. E. B. Hillman, of Quincy, officers and executive committee, and Messrs. J. J. Frey, of Hillsboro, and W. A. Thomas, of Abbington, insurance committee. Plans were discussed for the next convention, but no final decisions were made as to the place of meeting or program.

The Moloney Electric Company, of which Francis Raymond is the Chicago agent, made an exhibit of Moloney transformers in the booth of the Electro-Dynamic Company.

J. P. Sullivan & Co., of Chicago, decorators, had on exhibition in charge of W. H. Strange, the inventor, an electric rotary floor polisher. A one-sixth hp motor drives by a bevel gear a rotary pad which does the polishing. This will be put on the market soon.

Roth Bros. & Co. had a large number of small motors applied to different purposes. One of these was in connection with very small air compressors made by A. S. Comstock, of Evanston, Ill.

The Reynolds Electric Flasher Manufacturing Company was represented not only by its own exhibit which contained some admirable novelties in the flasher line, including a whirler," but by flashers on signs in a number of other exhibits around the show.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Winter trade has practically passed out of consideration, spring business absorbing all the attention. Optimistic reports are current of spring trade, and shipments are freely made, the open weather favoring the railroads. Very heavy buying of agricultural implements is reported at the West, which indicates an excellent condition of farming interests. There is also an indication of heavy acreage in cotton in the South. The railroads are doing an excellent business. Reports of leading roads for the first half of January are the best on record and indicate a gain of nearly 15 per cent over the same period last year. The open season favors demand for structural iron and steel, inquiries coming from all over the country and further large orders are in sight. Steel rails and wire products are in active request. It is stated that an immense amount of money is to be expended for new power plants at the Kleinfontein group of mines, South Africa. An American corporation, manufacturing engineeing apparatus, is making preliminary estimates. The steel and iron and machinery required for the undertaking will foot up in the millions. The electrification of the mine machinery now installed will effect a saving in capital, it is said, of $2,000,000. A local wire manufacturer has been asked to estimate upon long-distance power transmission projects in connection with the same undertakings. Collections generally range from fair to good, and money is easier and in better supply. The copper market was quiet during the week, no sales of importance being recorded. The principal selling agencies hold Lake and electrolytic at 18⅝c. for future delivery. The closing quotations are 18⅛c. for Lake and electrolytic and 18c. for casting stock. New business in machinery, electrical apparatus and tools is good, and heavy orders are pending. Exports of machinery to Germany are heavy owing to a desire to get supplies into that country before the new tariff becomes operative, on March 1. Bradstreet's reports 276 business failures during the week ending January 25, as against 279 the previous week and 228 in the corresponding week of 1905.

ORDERS FOR RONEY STOKERS.—The Westinghouse Machine Company, of East Pittsburg. Pa., has recently received numerous orders for its Roney mechanical stokers, the largest being from the Interborough Rapid Transit Co., 59th St. Power House, New York, to equip 7,200 hp of boilers; United Railways & Electric Co., Baltimore, Md., 3,600 hp; Twin City Rapid Transit Co., Minneapolis, Minn., 3,300 hp; Midvale Steel Co., Nicetown, Pa., 3,120 hp; Helena Power Transmission Co., Butte, Mont., 2,700 hp; Phoenix Iron Co., Phoenixvile, Pa., 1,800 hp; Union Salt Co., St. Louis, Mo., 1,660 hp; American Car & Foundry Co., Detroit, Mich., 1,050 hp, and St. Louis Portland Cement Co., St. Louis, Mo., 1,050 hp. Stoker equipments will also be installed by the Pennsylvania Light, Heat & Power Co.; Stanley Rule & Level Co.; Chicago & Alton Railroad; North American Chemical Co.; Firth-Sterling Steel Co.; Cedar Point Resort Co.; Coshocton Straw Paper Co., and Marion County (Ind.) Court House. Many of the above customers already have equipments of Roney mechanical stokers in service. Thus the United Railways & Electric Co. is already operating 17,500 hp in a double-deck boiler plant, which is now being extended; the Twin City Rapid Transit Co., 6,600 hp; Midvale Steel Co., 1,650 hp; Pressed Steel Car Co., 5,000 hp; Phoenix Iron Co., 6,700 hp; American Car & Foundry Co., 3,500 hp; Pennsylvania Light, Heat & Power Co., 1,600 hp; Chicago & Alton Railroad, 1,400 hp; Firth-Sterling Steel Co., 1,200 hp.

PABST BREWING PLANT.—In response to a demand for more power in its mammoth brewing plant at Milwaukee, the Pabst Brewing Company has recently placed an order with the Allis-Chalmers Company for three engines, one of the single cylinder, non-condensing type, cylinders 20 x 36-inch, and two of the cross-compound, non-conducting type, 18 and 30 x 36-inch, all vertical and of the heavy duty pattern for direct connection to electric generators. The electrical equipment ordered will consist of three revolving field type, alternating current generators, 25 cycles, one for 300 kw and two for 400 kw capacity; two exciter sets consisting of direct current, constant potential, compound-wound generators, coupled direct to three-phase synchronous motors and fitted with induction type of starting motors, and one exciter set consisting of a direct current generator of the same type as above for steam drive. A feature of the new installation will be a special governing device consisting of an electrical adjusting or synchronizing attachment by which the speed of the engines may be varied within certain limits while they are in operation, the device being under control of the operator at the switchboard. It is expected that the first of the new units will be in operation by the first of May. Mr. C. A. Chapman, of Chicago, has acted as consulting engineer for the Pabst Brewing Company.

ALLIS-CHALMERS ORDERS.—The Lunkenheimer Company, of Cincinnati, placed an order recently through the Cincinnati office of the Allis-Chalmers Company for a 425-kw type A.1. generator unit. The Pittsburg Plate Glass Company, whose complete power and electrical equipment for the new plant at Crystal City, Mo., was purchased from the Allis-Chalmers Company, has recently ordered two additional generators for the same plant. The Watab Pulp & Paper Company, of Sauk Rapids, Minn., whose entire electrical equipment of alternators and motors is being furnished by the Allis-Chalmers Company, has ordered another 100-hp motor for the same installation. The American Car & Foundry Company has recently concluded the purchase of an addition to the present power plant at its Huntington, W. Va., works. John C. Cummings, of Paris, Ill., has recently concluded the purchase of a 20 x 30-inch Reynolds Reliance Corliss engine, and the Gilbert Paper Company, of Menasha, Wis., has purchased an additional power unit for installation in the Menasha mill. The new unit is a 16 x 30-inch Reynolds Reliance Corliss engine.

GAS ENGINE SALES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has sold during the past few weeks 1,247 horse-power of its vertical gas engines to the following customers: A. Zimmerman, McKeesport, Pa.; Edgeworth Water Co., Edgeworth, Pa.; W. R. Morrow, Peru, Kan.; Standard Oil Co., Camden, N. J.; McClintic-Marshall Construction Co., Rankin, Pa.; Warren & Jamestown Street Railway Co., Warren, Pa.; The Wehrle Company, Newark, Ohio; Wm. R. West, New Bedford, Mass.; Sewickley Electric Light Co., Quaker Valley, Pa.; Youngstown Car Mfg. Co., Youngstown, Ohio.

THE LARGEST ORDER FOR OIL ENGINES has recently been awarded to the De La Vergne Machine Co., of New York, by Burnham, Williams & Co. (Baldwin Locomotive Works), Philadelphia, Pa. This is for engines aggregating over 3,300 actual horse power. Some are to be installed in Philadelphia, and the remainder at the steel works, at Burnham, Pa. The installation will consist of 125 and 250-hp "Hornsby-Akroyd" oil engines, some to be used for direct connection to electric generators and to air compressors, while others will be used for operating machine tools by belt.

THE ROBINS CONVEYING BELT COMPANY of New York has recently secured an order through its Boston office for a bucket elevator for the Bon Ami Company, Manchester, Conn. Among other orders now being filled by the Robins Company is one for a system of 14-inch belt conveyors and bucket elevator for the Pennsylvania Sand & Glass Company's plant at Granville, Pa., and an order from the Scofield Company, Philadelphia, for 30-inch and 18-inch conveyors for the Nashville Light, Heat & Power Company.

SOUTHERN POWER DEVELOPMENT.—Mr. F. G. Grove, general merchant at Luray, Va., informs us that Shenandoah River Power Company is installing a hydro-electric plant on the river about two miles west of Luray, and will buy apparatus to develop, at present, 600 hp with a view to enlarging later. The capitalization is $50,000. Mr. T. J. Berry is the president; Mr. C. S. Landram, vice-president; Mr. Lemuel Zirkle, secretary, and Mr. A. L. Jamison, treasurer, all of Luray.

TROLLEY IN PERU.—The work of converting the existing mule lines of the Compania Ferrocarriles Urbano de Lima into an electric road and the building of several miles of new track has been undertaken by W. R. Grace & Company, of New York. The General Electric Company has secured the contract for the electrical equipment. Forty-five cars will be used, the order for which has gone to the Stephenson car shops, at Elizabeth, N. J. They will be of the open summer type.

BIG INDUCTION MOTORS FOR THE ANACONDA.—Four of the largest induction motors ever installed in the West and some of the largest in the country, with the exception of those installed at Niagara, will be used to furnish power at the $9,000,000 reduction plant of the Anaconda Copper Mining Company, Anaconda, Mont. The Allis-Chalmers Company, of Milwaukee, will furnish this electrical equipment for the mammoth 8,000-ton concentrator and the street railway company at Anaconda. The concentrator equipment will consist of four 1,200-horse-power induction motors, three 300-kilowatt motor generator sets, together with the usual auxiliary accessories. This order is only one of many which will follow the determination of the Anaconda Company to substitute Missouri River power, transmitted 90 miles at 70,000 volts, for the present power system installed in the largest smelter in the world. Each of the big induction motors will weigh over forty tons, the weight of the entire equipment when ready for shipment being approximately 259 tons. The motors will be used in the concentration building, which is 600 feet long, through which a main line shaft extends the entire length. The motors will be rope connected to this shaft and will carry the entire power load.

MAYFAIR APARTMENT HOUSE.—A 12-story building of this name is to be erected at the southeast corner of 57th Street and Park Ave., New York City. Henry C. Tinker, owner, 139 Broadway; Charles A. Rich, architect, 320 Fifth Ave. Mr. Percival Robert Moses, E. E., 320 Fifth Ave., New York, will act as consulting engineer for the installation of a complete steam, electric, refrigerating and storage battery equipment, consisting of three 216-hp sectional boilers; three simple automatic horizontal high speed engines, two 13 x 12, and one 12 x 12 in., operating at about 300 r.p.m., direct connected to three compound wound multipolar 250-volt generators, two of 65 kw and one of 50 kw capacity, either three-wire machines, or two-wire machines with motor-dynamos for balancing. The refrigerating machine will be of 10 tons capacity. The storage battery will be used to supply electricity in conjunction with engine-dynamo sets for four electric elevators and one sidewalk elevator, and to supply lighting at nights in summer and in emergencies.

LARGE RAIL ORDER.—The United States Steel Corporation has obtained the largest contract ever let in this country for trolley rails for shipment abroad. The contract calls for 20,000 tons of girder rails for use in the construction of an extensive traction system in Rio de Janeiro. The record contract previous to this one was recently placed with the Lackawanna Steel Company for 16,000 tons of rails for the Havana Central Railway. The Rio de Janeiro Tramway, Light and Power Company, which is capitalized at $25,000,000, proposes, among other things, to construct about 200 miles of road. The existing mule lines, about 125 miles long, have already been acquired, and the work of converting them into electric motive power will begin immediately. The company has also obtained lighting, power and telephone concessions. Power to operate the various systems will be generated on the Parahyba and Lages Rivers, waterfalls on which are capable of developing in the aggregate about 150,000 horse power. Mr. F. S. Pearson is actively connected with this enterprise.

POWER PLANT FOR SOUTH.—The Westinghouse Electric & Manufacturing Company have recently closed a contract with the Southern Power Company, at Charlotte, N. C., for a large and complete power equipment consisting of eight 3,000 kw water wheel type alternators, with a complement of transformers, exciters and switchboards. This is the largest contract for electrical apparatus placed in the South for some years. The Southern Power Company's plant being situated in the midst of the cotton mill district will open up opportunities for the use of electric drive by the surrounding cotton mills and other industrial plants, which have heretofore been impossible because of the lack of cheap electric power in that vicinity. The Southern Power Company has full assurance that the cotton mills and other industries in the adjoining territory will make liberal use of the cheap power thus placed at their disposal.

MARINE ENGINE & MACHINE COMPANY, 126 Liberty Street, New York City, is busy with its elevator work. It has been rumored that it would give up this branch, but, on the contrary, it is as active as ever in this field, and is pushing vigorously on a number of contracts old and new. To use the words of a leading official, "They are in the elevator business to stay." The company is now making all the three classes of electric, hydraulic and plunger elevators, and reports the outlook as excellent.

9,700 HORSE-POWER HYDRAULIC TURBINE.—An interesting point in connection with the recent purchase by the California Gas & Electric Corporation, San Francisco, of a 9,700-horse-power, single-horizontal spiral case, reaction hydraulic turbine, is contained in the fact that this turbine will operate under a 550-foot head at a speed of 400 r.p.m., which is the highest head under which a turbine of this type has ever been installed. Until recently, manufacturers of secondary machinery have avoided the operation of their apparatus on high speeds. This prejudice, however, has, to a great extent, been overcome and it appears only a question of time when this type of hydraulic turbine will be constructed for still higher heads than the present practice will allow. This turbine and accessories will be furnished by the Allis-Chalmers Company, of Milwaukee, and is destined for installation at Chico, California, where the corporation controls the water rights.

ALLIS-CHALMERS STEAM TURBINE SOUTH.—Following the entrance of the Allis-Chalmers Company into the field of steam turbine manufacture, orders have already been received which will tax the capacity of the manufacturing departments, until the new turbine shops at West Allis can be made ready for use. Several smaller turbine generating units, 500 kw capacity, have recently been contracted for, among them the city of Jacksonville, Fla., which has recently concluded the purchase of additional steam turbine units for the lighting of that city in addition to a 500 unit installed there over a year ago. The new equipment will consist of two steam turbines coupled to two 500-kw, 3-phase, 60-cycle, 2,300-volt generators. These units will be the first steam turbines of Allis-Chalmers manufacture to be installed in the South.

ORGANIZATION OF THE ELECTRIC CABLE COMPANY.—The officers of the Electric Cable Company, of Bridgeport, Conn., which was recently formed to succeed the Magnet Wire Company and the Peerless Electric Company, both of New York, are: Edwin W. Moore, president; Frederick H. Cowles, vice-president; J. Nelson Shreve, treasurer, and H. S. Williston, secretary. The directors include Alfred Skitt, John Carstensen, Russel A. Cowles, Edwin W. Moore, Frederick H. Cowles, J. Nelson Shreve and H. S. Williston, all of New York; G. Tracy Rogers, of Binghamton, N. Y., and George C. Edwards, of Bridgeport. The company's New York office will be at 42 Broadway.

THE SPRAGUE ELECTRIC COMPANY is making a specialty of motor equipments, for driving heating and ventilating apparatus, and among recent orders for such equipments are the following: The First Day & Night Bank, Fifth Ave. and 44th St., the Knickerbocker Hotel, the Broad Exchange Building, the New Women's Hospital, all in New York City, and also the Hoboken terminal of the D., L. & W. Railroad.

BALTIMORE TROLLEY MOTORS.—The Westinghouse Electric & Manufacturing Company have received an order from the United Railways & Electric Company, of Baltimore, for one hundred No. 101-B four motor equipments complete with all details. This is in addition to a recent order for two hundred motors of the same type.

Financial Intelligence.

THE WEEK IN WALL STREET.—There were some irregularities in the stock market, although the tone was strong. The principal advances were in specialties of different kinds, notably Brooklyn Rapid Transit, which touched 94⅛ on favorable reports about the condition and prospects of the company. On the other hand, the formal announcement of the plan for the merger of the Interborough and Metropolitan interests failed to create any positive bullishness on the latter's securities. The United States Steel stocks developed strength on the prospect that the December quarterly report will be very favorable. Allis-Chalmers issues were active. Common touched 27⅜, which is the highest recorded figure in a year or more, but afterwards receded, closing at 25, the latter figure being a net gain of 1½ points. Preferred advanced ⅝ point, closing at 64. General Electric was quiet at quotations ranging between 179¾ and 177, the closing price being 177¼, which is a decline of ¾. Westinghouse common lost 5 points net, closing at 168; preferred closed at 188. The closing quotations of American Locomotive common and preferred were 74½ and 118 respectively. Among the tractions, Metropolitan Street Railway closed at 124¾, which is a net decline of ¼ point; Brooklyn Rapid Transit at 91⅜, a gain of ¼, and Interborough Rapid Transit at 236, an advance of ½. Tele-

phone and telegraph stocks were on the downward turn. American Telephone & Telegraph closed at 141, a loss of 2 points; N. Y. & N. J. Telephone, 154½, a decline of ½ point; Western Union Telegraph 93¼, a drop of ¼ point, and American Telegraph & Cable at 90. The curb market was irregular, and, in the main, prices receded under continued profit-taking sales. The mining group was the centre of pressure, with the principal declines in Boston Copper and Greene Copper. The closing quotations on the Stock Exchange January 30 are given in the following table:

NEW YORK

	Jan. 23	Jan. 30		Jan. 23	Jan. 30
Allis-Chalmers Co	25⅜	23⅛	General Electric	178	173
Allis-Chalmers Co. pfd	65⅝	62⅛	Hudson River Tel.	...	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	234	232
American Locomotive	72⅝	74⅜	Mackay Cos.	62¾	59⅛
American Locomotive pfd.	118	116¾	Mackay Cos. pfd.	75	73
American Tel. & Cable	80	87	Marconi Tel.	...	..
American Tel. & Tel.	140	137	Metropolitan St. Ry.	124¼	121⅜
Brooklyn Rapid Transit	91¼	86⅛	N. Y. & N. J. Tel.	...	..
Electric Boat	25	25	Western Union Tel.	93½	93¼
Electric Boat pfd	60	60	Westinghouse com.	171	166
Electric Vehicle	15	17	Westinghouse pfd.	...	..
Electric Vehicle pfd.	21	22			

BOSTON

	Jan. 23	Jan.		Jan. 23	Jan.
American Tel. & Tel.	141	139	Mass. Elec. Ry. pfd.	68¼	67⅛
Cumberland Telephone	117¼	117	Mexican Telephone	3½	..
Edison Elec. Illum.	..	..	New England Telephone	139	139
General Electric	..	..	Western Tel. & Tel.	15	..
Mass. Elec. Ry.	18⅜	..	Western Tel. & Tel. pfd.	93	92½

PHILADELPHIA

	Jan. 23	Jan. 30		Jan.	Jan. 3
American Railways	53¾	53	Phila. Electric	8	8¼
Elec. Co. of America	12	11⅞	Phila. Rapid Trans.	32¾	32
Elec. Storage Battery	85	81	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Jan. 23	Jan. 30		Jan. 23	Jan. 30
Chicago City Ry.	...	200	National Carbon	...	80½
Chicago Edison	...	...	National Carbon pfd.	...	116
Chicago Subway	51¾	...	Union Traction	...	..
Chicago Tel. Co	...	...	Union Traction pfd.	...	..
Metropolitan Elev. com.	...	26			

NORTH AMERICAN ANNUAL.—President Wetmore of the North American Company, which controls streets railways and lighting properties in Milwaukee, Cincinnati, St. Louis, Detroit, and many other cities in the Middle West, makes an encouraging annual report and says: "The business activity and prosperity now prevailing may be interrupted for short periods from time to time, but I do not believe that even in periods of depression the properties in which the North American Company is interested will cease to grow in earning capacity from year to year and to a material extent. So great is the field still undeveloped for the exploitation of the sale of gas and electricity, so rapidly does the taste for riding grow with the continuous improvement of facilities and so constant is the growth of population that business reaction, even severe and prolonged, may well pass without serious effect upon the growth of the earnings of these corporations." Mr. Wetmore says that the properties owned by the company have now passed the difficult and perplexing stages of construction and betterment. The report shows that the Milwaukee Electric Light & Power Company, one of the subsidiaries, has sold for delivery during the present month $2,000,000 of its recently authorized bond issue of $20,000,000. To provide for the completion of its construction work and to reimburse its treasury for capital expenditure the Union Electric Light & Power Company of St. Louis has just issued and sold $3,000,000 of three-year collateral trust notes. The income account for the year, including previous balances, follows:

	1905.	1904.		Changes.
Total receipts	$4,192,728	$2,832,578	Inc.	$1,360,150
Dividends paid	1,252,996	840,834	Inc.	412,162
Commissions paid	127,500	...	Inc.	127,500
Total	$1,380,496	$840,834	Inc.	$539,662
Surplus	$2,812,232	$1,991,744	Inc.	$820,488

AMERICAN LIGHT & TRACTION.—The American Light & Traction Company's annual report for the year ending December 31, 1905, shows net increased earnings over the previous year of $203,657, or 17.98 per cent. The company's earnings for the last three years compare as follows:

Year.	1905.	1904.	1903.
Earnings on stock of sub. companies owned by this company	$1,222,785	$1,007,001	$970,479
Miscellaneous earnings, interest, etc.	150,835	144,502	110,371
Gross earnings	$1,373,620	$1,151,503	$1,080,850
Expenses	37,452	18,993	30,539
Net earnings	$1,336,168	$1,132,510	$1,050,311
Dividends	747,328	669,132	553,060
Surplus	$588,840	$463,378	$497,251

During 1905 the dividends paid on the preferred stock was at the regular rate of 6 per cent per annum. Beginning with August 1, 1905, the dividend on the common stock was increased from the rate of 3 per cent annually to 4 per cent annually. During the year the company added to its list of properties those of the Quebec-Jacques Cartier Electric Company, of Quebec, Canada; the Muskegon Traction & Lighting Company, of Muskegon, Mich., and the Lacombe Electric Company, of Denver, Col. The company has $9,633,200 of preferred stock, and $15,000,000 of common. The investment account is $24,103,177.

REFRIGERATOR CONSOLIDATION.—News comes from New Brunswick, N. J., of the merger of the New Brunswick Refrigerator Company and the Union Refrigerator Company with a capital stock of $2,000,000. This merger went into effect on Jan. 2, but the details of the consolidation and the names of the new directors and officers of the combine were not made public until last week. The new directors of the company are Robert W. Johnson, James W. Johnson, president of the Neverslip Company, of New Brunswick; W. Campbell Clark, Theodore Frelinghuysen, Archibald Cox, A. M. Coats, T. G. Phinny, C. A. McCormick, of New Brunswick, and James Henry Smith. At a recent meeting of these directors the following officers were elected: J. W. Johnson, vice-president; T. Clark, New York City, vice-president; T. G. Phinny, secretary; Theodore Frelinghuysen, treasurer. The new financiers in addition to those who have been already interested in the old companies who have identified themselves with the new concern are: W. Campbell Clark, head of the Clark O. N. T. Thread Company; Theodore Frelinghuysen, head of the thread trust; A. M. Coats, president of the Coats Thread Company, and Archibald Cox, a New York City lawyer. It is proposed to make this one of the largest refrigerator corporations in the country.

AMERICAN LIGHT & TRACTION.—The directors of the American Light & Traction Company have authorized another issue of common and preferred stock to finance the purchase of a large electric light and traction system, the location of which has not yet been made public. The new issue will amount in all to $5,500,000 and will comprise 15,000 shares of common stock and 40,000 shares of preferred. It was only a month ago that the American Light & Traction Company offered stockholders the right to subscribe to $718,900 worth of common and preferred stock to furnish funds for the purchase of electric companies in Michigan and Colorado. The subscription rights expired last week and all the new stock was taken up. The newest issue is offered to stockholders at par in the proportion of ten shares of common and twenty-seven shares of preferred for each 100 shares of their holdings.

MICHIGAN STATE TELEPHONE.—The Michigan State Telephone directors have approved estimates of expenditures for improvement extensions for 1906 aggregating $1,260,000; about 20,000 more telephones will be installed. Dudley E. Waters, president of the Grand Rapids National, was elected vice-president to take the place of Truman M. Newberry, whose duties as assistant secretary of the navy prevented him from giving the office the necessary time. The common stock of the Michigan State Telephone Company has advanced during the past three or four weeks from $35 to $50 per share. The preferred stock is selling at $95 per share. Nearly $600,000 was spent in maintenance for the year ended April 30, 1905, all of which was charged directly to expenses.

INTERBOROUGH-METROPOLITAN.—A holding company to carry through the recent New York merger has been formed, called the Interborough Metropolitan Company, to hold stock and bonds of companies operating transportation lines in New York and vicinity and of corporations holding securities of companies engaged in such business. Capital, $15,000. The directors are Walter G. Oakman, John B. McDonald, Morton F. Plant, New York; James Jordan, Brooklyn; P. A. B. Widener, Philadelphia.

SOUTH SIDE ELEVATED, Chicago, shows for 1905 a gross of $1,713,347 and a surplus after all dividends and charges of $217,470. Eighty-two per cent of the third track is now erected and 150 new cars are arriving. The company's power supply is greatly increased. The total number of passengers carried during the year amounted to 32,959,752. The daily average was 90,301, an increase of 8.47 per cent.

A LARGE BLOCK OF STOCK in the Chicago City Railway was held by the late Marshall Field, and the amount was estimated at his death, last week, at $10,000,000.

WESTINGHOUSE BONDS.—Kuhn, Loeb & Co. have purchased an issue of $15,000,000 convertible sinking fund 5 per cent gold bonds due January 1, 1931, of the Westinghouse Electric & Manufacturing Company. The bonds are to be convertible into "assenting stock of the company at 200 after January 1, 1910, and redeemable after January 1, 1912, at 105 and accrued interest." From the proceeds of the bonds the company will retire all of its outstanding commercial paper and will have left ample capital to provide for extensions and for its continually increasing business. The trust indenture under which the bonds are to be issued is to provide that the property of the company shall remain unmortgaged and is also to contain stipulations as to special security for the bonds. There will be an annual sinking fund of $500,000 beginning with December 31, 1907. Stockholders can subscribe at 98 to the extent of 60 per cent of their holdings. In connection with the new issue, Mr. Westinghouse has issued a circular which shows average net earnings of $3,626,388 a year over the last five years. The following statements have been certified by Haskins & Sells, certified public accountants: The average annual net earnings of the company and its said subsidiary companies for the five years ended March 31, 1905, available for interest and dividends, have been $3,626,388; the earnings available for interest and dividends for the eight months ended November 30, 1905, were $2,488,641; the annual amount required to pay the interest upon the $15,000,000 of bonds and all other interest charges, is $1,231,000.

AMERICAN DISTRICT TELEGRAPH.—The American District Telegraph Company of New York has issued its full report for the year ended December 31, 1905. The income account compares as follows:

	1905.	1904.	1903.
Revenue from all sources	$593,694	$561,062	$577,676
Expenses—all classes	498,320	483,699	511,808
Net	$95,374	$77,363	$65,868
Dividends	76,888	76,888	76,888
Surplus	$18,486	$475	*$11,020
Miles wire	1,587	1,584	1,552
Offices	87	87	85
Instruments	32,234	30,881	29,143

*Deficit.

President Clowry reports a gratifying increase in the business of the company, due largely to improved conditions in the financial district, reflected in the earnings for the year, which show an increase of $32,633. The increase of $14,622 in the expenses of the company is principally due to increased business, but the figures include some back taxes which had been allowed to accumulate pending a final decision in the franchise tax cases. Notwithstanding this unusual disbursement, the net earnings show an increase of $18,011. Thirty-three new office buildings were wired during the year, and the number of instruments in circuit on December 31 was 32,234. The cost of this and other new work amounting to $15,528 was paid out of the earnings, and is included in the expenses of the year.

NEW YORK TRACTION MERGER.—Official announcement is made of the plans for the organization of the traction merger under the name of the Interborough-Metropolitan Company. The securities to be issued are $55,000,000 5 per cent cumulative preferred stock, $100,000,000 common stock, $70,000,000 4½ per cent collateral trust bonds. All the common stock is to be held for a term of years in a voting trust. A committee, consisting of E. J. Berwind, chairman, John D. Crimmins, Andrew Freedman, Thomas P. Fowler, Gardiner M. Lane and Cornelius Vanderbilt, has entered into an agreement with August Belmont & Co. under which they represent the stockholders of the old companies in forming the new. Belmont & Co. have agreed, in return for the $8,700,000 common stock not used for exchange of securities, to furnish the new company $2,250,000 cash and bear all expenses of organization, also to subscribe for $3,000,000 of the preferred stock at par in cash. Holders of stock of the old companies may exchange them for securities of the new company on the following terms: For each share of Interborough Rapid Transit Company: collateral trust bonds, $200; common stock, 99. For each share of Metropolitan Street Railway: preferred stock, $100; common stock, 55. For each share of Metropolitan Securities Company ($75 paid) common stock, $93.50. Some strong opposition is developing to the merger.

BOSTON ELEVATED BONDS.—On January 15, 1905, Boston Elevated bonds became a legal investment for Massachusetts savings banks, the Board of Railroad Commissioners having certified to the Savings Bank Commissioners that the road had paid 5 per cent or more in dividends annually for a period of five consecutive years.

ABSORBING PHILADELPHIA COMPANY.—It is announced that the United Railways Investment Company of San Francisco has arranged to make a proposition to the stockholders of the Philadelphia Company to retire a certain amount of the common stock in exchange for bonds in the investment company, which is to become the holding company. The Philadelphia Company stockholders will be asked to accept bonds on the basis of $40 and $15 in common stock in the holding company in exchange for each share of Philadelphia common stock. The Philadelphia Company has a capital of $30,000,000 common and $6,000,000 preferred. The United Railways Investment Company controls all the street car lines of San Francisco. It has a capital of $10,000,000 common and $15,000,000 preferred, and it is proposed to increase the capital stock to $40,000,000 by issuing $15,000,000 more common stock. Thalman Ladenburg, of New York, is president of the investment company. The Philadelphia company stock now pays 6 per cent, while the bonds to be issued will pay but 5.

DIVIDENDS.—The directors of the Michigan State Telephone Company have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable February 1 to stock of record January 23, 1906. Directors of the New York Consolidated Gas Company have declared the regular quarterly dividend of 2 per cent, payable March 15. Directors of the United Power & Transportation Company have declared a dividend of $3.10 per share, payable January 26. The Boston Elevated Railway Company has declared the regular annual dividend of 3 per cent. The directors of the Lawrence, Mass., Gas Company have declared the regular semi-annual dividend of 3 per cent, payable February 1. The directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¼ per cent on the common stock to stockholders of record February 1.

TOLEDO RAILWAYS & LIGHT.—The Toledo Railways & Light Company report shows a surplus December 31, 1905, of $988,829, as compared with $841,807 the year previous. Its bonded indebtedness December 31, 1905, was as follows:

Underly. 5 per cent bonds maturing July 1, 1909	$5,300,000	
Underly. 5 per cent bonds maturing Feb. 1, 1912	700,000	
		$6,000,000
Toledo Rwys. & Light Co. 4 per cent bonds maturing July 1, 1909		4,854,000
Total		$10,854,000

During 1905 the company operated 107⅜ miles of track, earning $1,407,626, or $13,109 a mile. It is now supplying the city with 1,322 arc lamps and furnishing current for the equivalent of 158,243 16-cp incandescent lamps and for 6,583 hp of motors.

MANILA RAILWAY & LIGHTING.—A part of the outstanding $4,635,000 of the 50-year 5 per cent first lien collateral trust bonds of the Manila Electric Railway & Lighting Corporation are to be put on the market through William Salomon & Co. The bonds are a first lien on the properties of the Manila Electric Railroad & Light Company through the deposit of all of the $3,000,000 first mortgage 6 per cent bonds, as well as by the deposit of the entire capital stock of this subsidiary company. They are secured also by the deposit of 95 per cent of the capital stock of an underlying electric lighting company known as "La Electricista," and the entire capital stock of the Union Trucking Company. Neither of these latter companies has any bonded debt. The Manila trolleys shows a net surplus for six months of $106,293.

PIONEER TELEPHONE'S GROWTH.—The fiscal year of the Pioneer Telephone & Telegraph Company, which ended December 31, 1905, was an exceedingly satisfactory one. The company is capitalized for $3,000,000, has 13,000 regular subscribers and 12,600 miles of toll wire. It has been controlled by the American Telephone & Telegraph system since the early part of May. The stock has been paying 6 per cent during the year and ten months in which the company has been in existence, and there is some possibility of an increase in the rate being made at the meeting of the directors to be held about February 1. The company's stock is very largely owned in Oklahoma and Indian Territory, the district which it serves. It has been the policy of the management to encourage the local stockholders to retain their holdings.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company shows for 1905 a gross income of $4,656,423, expenses of $2,976,972, a net of $1,979,451, and after charges a net surplus of $1,359,284. The gross shows a gain over 1904 of over $600,000, but the surplus gained only $185,116.

General News.

SAN JOSE, CAL.—Work has been started by the San Jose-Los Gatos Interurban Railroad Company on the San Carlos, Thirteenth and San Fernando Street loop branch, which will cover about five miles.

IMPERIAL, CAL.—W. F. Holt states that the Holton Power Company expects to complete its plant at Holtville and get transmission lines up within 90 days. The machinery for four sub-stations has been shipped. The power station at this place will also be installed within the time stated.

BAKERSFIELD, CAL.—Recent high water in the Kern River caused a slight damage to the Edison Electric Company's concrete dam which is being built at the upper end of the company's gravity tunnel for its large hydro-electric station. It is now expected that the power system will be ready for the water to be turned on by July.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, together with the California Gas & Electric Corporation and other subsidiary companies, has moved its offices from the Rialto Building to the new Shreve Building at the corner of Grant Avenue and Post Street, where it will occupy the eighth and ninth floors.

LONGMONT, COL.—The Longmont Electric Light & Power Company has made arrangements with Lafayette coal fields to supply its power, and the plant here will be put out of commission as soon as the line can be built. The local company will buy electric power from the Lafayette Company and retail light and power to the residents of Longmont.

OURAY, COL.—A meeting of a number of electric light consumers of this city was held recently for the purpose of arriving at some plan for bettering local conditions. Considerable dissatisfaction, it is said, has been expressed regarding the service rendered by the Ouray Light & Power Company, and it has been suggested that the Animas Water & Power Company, located at Silverton, might be induced to run a line to this city and furnish power and light, but no definite action has been taken.

UNCASVILLE, CONN.—It being fully recognized by the residents that street lights are needed in some sections, it has been suggested that arc lamps could be put in and supplied with current from the wires of the Consolidated Railway Company.

HARTFORD, CONN.—It is stated that the Consolidated Street Railway Company, which belongs to the New Haven, has acquired the Hartford, Manchester & Rockville Tramway Company, owning a line from Hartford to Rockville with branches, and that the Consolidated can now run a direct service from Hartford to Worcester without competition.

ROCKVILLE, CONN.—Contractor H. Wales Lines, of Meriden, has a force of men at work on the erection of a power plant at West Street for the Consolidated road. This is to be one of two brick sub-stations, which when equipped with electrical machinery will cost from $8,000 to $10,000 for the new system of trolley cars to be run on the steam road between Hartford and Rockville. The power for running the new line will be supplied by the Hartford Electric Light Company.

ADEL, GA.—A meeting has been held for the purpose of forming an electric light company and subscriptions are being taken to the stock. M. T. Shaw is at the head of the soliciting committee.

HAILEY, IDAHO.—P. H. Hopkins, collections agent of the Rocky Mountain Bell Telephone Company says that the telephone business is growing so rapidly that the company cannot keep up with it. Hailey and Boise are in the Central Idaho district. In this district alone the company intends to spend over $200,000 in betterments; and it will doubtless spend five times as much in its whole territory. There are 9,500 telephones in use in Salt Lake, 2,300 in Boise, 175 in Hailey and 63 in Bellevue.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company, which furnishes light for this city, has just completed the installation of a large motor-generator in its Circle Street station. The new machine will be used in the conversion of 4,000-volt alternating current from the Mill Street and Kentucky Avenue power station into 250-volt direct current.

MILL CREEK, I. T.—The City Council here has granted a franchise to the Mill Creek Electric Light and Power Company.

NEW ORLEANS, LA.—At a meeting of the directors of the New Orleans & Carrollton Railroad Light & Power Company on January 22, the following officers were elected: E. C. Foster, president; Joseph H. De Grange, vice-president; H. A. Ferrandon, secretary and treasurer.

CARTHAGE, MO.—The Empire Electric Power & Supply Company has increased its capital stock from $10,000 to $25,000.

MILO, ME.—The electric light company has purchased a new generator to be used on the Pierce power. As soon as this is installed the company will run this portion of the plant all night.

PORTLAND, ME.—The Maine sanitorium has placed two boilers of 100 hp each in its new lighting and heating plant. These boilers will serve steam to an engine for the electric plant of 600 lights. The pumping for the water supply will be done by electric pumps furnished with current from the generator. The power house has been made large enough for the installation of another boiler of 150 hp in the boiler room, and another engine and generator in the engine room.

WELLESLEY, MASS.—Wellesley has appropriated $5,000 for street lighting by electricity.

NORTH ADAMS, MASS.—A bill has been introduced into the Legislature giving the gas and electric companies in the vicinity of North Adams permission to extend their business into the towns of Monroe, Savoy and Florida.

WRENTHAM, MASS.—Moses T. Farnum, proprietor of the Glenwood Mills, is considering the idea of furnishing electric light for the village. The pond at Glenwood has a fall of 14 feet, which would run a dynamo of sufficient power to light the town.

HAVERHILL, MASS.—A proposition for Welsbach street lighting having been presented, the Haverhill Electric Company has addressed a communication to the Mayor and City Council offering to submit a bid on any desired schedule, giving better light and more light at substantially less cost per annum.

SOUTH DEERFIELD, MASS.—A new electric plant has been erected in this town to furnish power for a private enterprise, but arrangements had been made to furnish current for street lighting. No notice has been given as to when the plant would start, and the recent turning on of the lights was a pleasant surprise for the inhabitants.

HAVERHILL, MASS.—The new $100,000 alternating-current turbo-generator plant of the Haverhill Electric Company on Water Street has been completed and Chief Engineer Charles Monroe, who has installed the plant for the General Electric Company, has turned on all the power and put the old plant completely out of commission. The change includes everything from boilers and engines to switchboards.

GREENFIELD, MASS.—The annual meeting of the Greenfield Electric Light and Power Company shows the affairs of the corporation to be in a favorable condition. There has been a profit of about ten per cent, including the five per cent which the State authorities require to be set aside for depreciation of plant. George W. Lawrence, who was recently elected superintendent, was chosen treasurer to succeed Andrew J. Doolittle.

WINCHENDON, MASS.—State Senator Morton E. Converse, Elisha Whitney, Wendell Clark, Zadoc L. White, W. M. Whitney and C. L. Beale appear as incorporators of the Fitchburg, Ashburnham & Winchendon Street Railway Company, for whose incorporation a petition has been filed in the Senate. It is proposed to build a line through Ashburnham, Winburnham, Winchendon, Winchendon Springs and Waterville to the town line of Fitzwilliam, N. H. Another route is also proposed, running through Gardner. It is stated that the road will be capitalized at $250,000.

TEMPLETON, MASS.—The selectmen have been presented a petition signed by 20 citizens, asking for a special town meeting to see what action the town of Templeton will take toward having the streets lighted with electric lights. The H. B. Rust Co., of Providence, offers to construct an electric light and power plant, and to furnish electric lights, heat and power, provided the town will vote to use 75 25-cp street lights at a cost of not more than $20 per light per year, and if the citizens will subscribe for 2,000 16-cp incandescent lights for lighting purposes in residences, factories and stores. The selectmen will call a special meeting at an early date. The H. B. Rust Company offers to have the plant in running order by July 1.

MANKATO, MINN.—Farmers of Danville, Vivian and other townships north of Minnesota Lake have organized the Farmers' State Telephone Company. A line will be constructed to connect with the Northwestern at Minnesota Lake. Work will begin at once.

WILLMAR, MINN.—Negotiations have been closed whereby the Northwestern Telephone Company secured control of the Minnesota Central Telephone Company, whose offices are located in this city. The Minnesota Central Company was organized in 1897, with D. N. Tallman as president, with $50,000 capital and lines covering an area of about 200 miles. At the present time the lines cover 2,000 miles of territory and the capital invested amounts to nearly a million dollars.

LAMBERTVILLE, N. J.—The Lambertville Heat, Light & Power Company has elected the following officers for the present year: President, H. C. Case; vice-president and secretary, S. C. Case; general manager, H. M. Moorhead.

NEW YORK, N. Y.—It is authoritatively announced that the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, has purchased the Hartford, Manchester & Rockville Tramway Company, the Stafford Springs line, and the rights to complete the Hartford & Worcester Street Railway. This will in no way affect the electrification of the present steam road between Hartford and Rockville, which will be carried out as proposed in the original plan.

NEW YORK, N. Y.—Mr. William C. Gotshall, president of the New York & Portchester Railroad, has declared to the New York City board of estimate that the purchase by the Westchester interest of the New York Railroad & Development Company did not carry with it all the rights of the Port Chester Company. He alleged that Gates and the others who sold out the New York Railroad & Development Company that had been organized to build the New York & Port Chester Railroad, had simply sold a gold brick. Chas. D. Barney & Co. are in physical possession of the stock of the Port Chester, and the Port Chester is going ahead to build notwithstanding the action of Gates and his associates.

ROCHESTER, N. Y.—The first section of the Rochester, Syracuse & Eastern Railway has been completed for operation. The road is a double track interurban electric railway and the part completed from Rochester to Lyons is 36 miles long. The whole road will be 80 miles long. Two transmission lines have been provided and lines for carrying the high tension current are carried around the towns on the route. The

contract for the construction is being carried out by the engineering firm of J. G. White & Co. This line parallels the New York Central. The Rochester, Syracuse & Eastern Ry. Co. has an authorized capital of $2,500,000 6 per cent non-cumulative preferred and $1,000,000 common stock.

KEENE, N. H.—The Citizens' Electric Company of this city has filed with the city clerk a certificate stating that the full amount of its capital stock of $50,000 has been paid in.

NASHUA, N. H.—The price of gas and electricity in this city is to be reduced after March 1. The present net price of gas is $1.40 per 1,000 cu. ft. It will be $1.30. The net price of electricity per kilowatt hour is to be reduced from 16 to 14 cents.

CHARLOTTE, N. C.—Superintendent M. B. Spier, of the Charlotte division of the Southern Bell Telephone Company, has succeeded in purchasing for his company the local exchanges at Laurinburg and at Gibson, N. C.

CINCINNATI, OHIO.—Bids will be received until February 23 by the Board of Trustees, Commission of Water Works, for furnishing, delivering and erecting three direct-connected electric units of 150-kw capacity each, driven either by a turbine or reciprocating engine; one switchboard; two air pump and condenser units, and all necessary appurtenances.

TOLEDO, OHIO.—The F. Bissell Company, of Toledo, O., has a contract with the Ohio Cultivator Company of Bellevue, O., for two Northern generators, five Northern motors, switchboard and twenty-five Jandus arc lamps. It also has a contract with the Zaner Bros. Company, of Toledo, for one Northern generator of the engine type, switchboard and 15 motors. In addition to above, it is also furnishing the Toledo-Massillon Bridge Co. one 150-kw Northern generator, switchboard and several motors.

CLEVELAND, ORE.—A meeting of the citizens has been called to consider the advisability of establishing a telephone system between Cleveland and Roseburg.

PORTLAND, ORE.—At the annual meeting of the Portland General Electric Company, held in Portland, Ore., January 17, directors were elected for the ensuing year. The directors will at their first meeting re-elect the present officers of the company. The last year's progress made by the Portland General Electric Company has been great, and its plans for the coming year are extensive. During the year 1905 it completed a new steam plant in Portland, practically doubling its power-producing capacity. The steam plant, producing 12,000 hp, was utilized largely in lighting the Lewis and Clark Exposition, and now that the fair is over the power will be turned into the regular channels of commercial lighting, where all of it is needed. By an issue of $6,000,000 new bonds the company refunded and consolidated its indebtedness, at a lower rate of interest, and had a surplus to spend for improvements and extensions. During the present year about $1,000,000 will be spent in Portland in the erection of a 5-story office building and reconstruction of the arc lighting system. The present coke-carbon lamps will be taken down and magnetic arc lamps will be installed. About 1,200 arc lamps are required to light the city on the present plan of distribution. The new lamps will require new apparatus at the power station and a renewal and rearrangement of the lighting circuits. The alternating current used primarily will be changed to a direct current by means of mercury tube rectifiers. These rectifiers and new transformers will be installed. The company's architects are now at work on plans for the new office building, and these will be completed in about a month. Work will be commenced on the building early in the spring.

DOWNINGTON, PA.—Engineers representing the Philadelphia & Western Railroad have been at work in Chester County for some days past, and it is understood that work on the line will be pushed west of Strafford as soon as that section of the road is completed. It is expected that the line between Philadelphia and Strafford will be in operation by July 1.

ANDERSON, S. C.—Negotiations are in progress for the absorption of the Anderson Telephone Company by the Bell Company. The Bell interests will operate under the franchise of the local company, it is stated.

LAURENS, S. C.—The Reedy River Power Company has been organized under a charter granted by the General Assembly of South Carolina. The capital stock of the company is $50,000, and every dollar is subscribed. The board of directors is J. O. C. Fleming, J. H. Sullivan and N. B. Dial, all of this city. Mr. Dial is president and treasurer. The company will engage in generating and transmitting electrical power, and the plant will be at Boyd's Mill, on Reedy River, ten miles east of Ware Shoals. Bids for doing the construction work have already been received and the development of this splendid water power will begin as soon as some preliminaries can be arranged.

MIDDLEBROOK, VA.—H. McGrary, secretary and treasurer of the Virginia Valley Traction Company, says that his company proposes to build an electric railway 27 miles long from Staunton, Augusta County, into Rockbridge County, by way of Middlebrook. It is expected that the company will be ready for bids in April.

BRADFORD, VT.—The power house of the Bradford Electric Lighting Company has begun operations, and Bradford and Newbury are now lighted. The dynamo is driven by a 400-hp water wheel.

Construction News.

STEPHENS, ARK.—The Council has granted to T. A. and G. Lewis a franchise to build and operate a telephone exchange at Stephens.

HARRISON, ARK.—An agreement has been reached between the City Council and Mr. Quigley for an electric light plant, water works system and an electric railway. It is proposed to construct an electric railway from Harrison to Bergman, the nearest point on the new White River line, ten miles from this place.

SPRINGDALE, ARK.—Plans, specifications and final estimates have just been completed for an electric lighting plant and lighting system for Springdale, Ark. W. K. Palmer, consulting engineer, 718 Dwight Building, Kansas City, Mo., has prepared the plans and specifications and these are on file at his office in Kansas City for the examination of prospective bidders.

NAPA, CAL.—The Supervisors have granted a franchise for an electric light and power line and system along certain roads of this county, to J. S. McDonald, whose bid was $302.50.

NAPA, CAL.—The Board of Supervisors has resolved to grant the franchise for 50 years to construct and maintain telephone lines in Hot Springs precinct, as applied for by R. F. Grigsby, and the clerk was ordered to advertise for bids to be opened on March 13,

HAYWARDS, CAL.—The Suburban Electric Company has decided to construct its own plant on the Bay Shore, instead of taking power from an outside source. William Angus, of San Leandro, is manager of the company.

ALAMEDA, CAL.—J. W. Gillogly, City Clerk, writes that Charles E. Moore & Co., of San Francisco, have secured the contract for an engine for the municipal electric light plant at $8,718, and that the National Electric Company, of Milwaukee, Wis., was given the contract for a generator at $4,670.

SAN FRANCISCO, CAL.—The North Mountain Power Company, of San Francisco, which has a hydro-electric plant near Junction City, Trinity County, has awarded Hunt, Mirk & Co., of this city, a contract for an additional generating unit, consisting of a Westinghouse-Parsons steam turbine. This will be installed in the auxiliary steam plant of the company at Eureka, which carries a good deal of the lighting load of Eureka.

LOS ANGELES, CAL.—The Pacific Construction & Supply Company, Examiner Building, Los Angeles, has recently come into existence with the object of carrying on a business in general building. The organization is complete, in that each of the directors and officers is also a departmental superintendent, of whom there are seven. Mr. J. C. Greeu is at the head of the electrical department and Mr. A. C. Dale of the sanitary and heating.. These and the other officers are also supervisors of all work that comes under their respective departments and to them is left the buying and ordering of material.

MERIDEN, CONN.—The Jennings & Griffin Company's factory in Tracy with the Indianopolis Northern at Logansport.

WILLIMANTIC, CONN.—It is reported that engineers are looking over the line of the Shetucket River below South Windham. A good water privilege is located in that vicinity and the surmise is that the Consolidated railway company have an eye on it for electrical purposes.

MIDDLETOWN, CONN.—It is said on good authority that the Consolidated Street Railway Company is planning to lay a trolley line for some distance along the river and connect it with the main trolley lines now in use in the city. It will be mostly for the purpose of carrying freight.

GEORGETOWN, COL.— A. Maxwell, of this city, engineer for the East Argentine Mining Company, writes that the specifications have not yet been completed for the proposed power plant. It is planned, however, to construct about 80 miles of transmission lines, and the probable cost of the work is estimated at $4,000,000. Bids for the construction will probably be called for in March.

GUNNISON, COL.—It is stated that bids will be received until February 14 by F. W. Harper, town clerk, for constructing a complete electric lighting plant.

ALBANY, GA.—Preparations are being made to extend the municipal lighting system to Arcadia.

WALLACE, IDA.—It is stated that the Federal Mining Company will build a big power plant at Thompson Falls, Idaho, to supply the mines and mills of that district. The plans include electric railways to all camps of the district.

QUINCY, ILL.—A. J. Thomas and W. S. Freeman are interested in a project to construct an electric railway from Quincy to Hardin.

PEORIA, IIL.—Independent telephone owners of the State met at Peoria recently to discuss plans for extension. One of the objects of the meeting was to arrange for connection with the toll lines which the Inter-states' Company will build immediately to Washington and from there connect with the through circuit north and south from Springfield to the outskirts of Chicago. In order to bring the toll business to Peoria, the Inter-states people now have in process of construction a line to Hanna City and Trivoli. When spring opens the poles will be set into Elmwood, Yates City and through Galesburg to this city. .

CHICAGO, ILL.—To take care of its rapidly increasing business and also to install new apparatus to add to the efficiency of its service, the Chicago Telephone Company has planned a large addition to its present downtown office building and central exchange, as well as new exchanges in outlying districts. According to specifications the new building will be 14 or 16 stories high and will cost from $750,000 to $1,000,000. The building has been proposed to anticipate requirements of a franchise renewal ordinace with the city, negotiations for which are now under way. It is one of the features of the company's plans to broaden, popularize and cheapen telephone service throughout the city. The new building will be erected on the rear portion, 80x80 feet, of a lot east and adjacent to the present structure of the company at Franklin and Washington Streets. The front end of this lot is at present occupied by the Forbes building, which will ultimately be razed and its site occupied by an addition to the building now proposed, fronting on Washington Street. Among other equipment, an elaborate new toll board will be installed. Work on the structure will be rushed as soon as an equitable agreement with the city is made. The present ordinance expires in 1909. The new branch exchanges planned are one between Lake View and Rogers Park, and one on the West Side, between the west exchange and Austin. Enlargments of other exchanges are also being considered.

LEESBURG, IND.—A franchise has been granted by the Town Council to John E. Armstrong, William R. Wood and Walter H. Stanley, to furnish electric light, heat and power in this city.

CENTERVILLE, IND.—Steps have been taken by the Town Board and the citizens generally toward the building of an electric light plant here. Nimrod Parrott, H. H. Peele and Harry Anderson constitute the building committee.

MONROE CITY, IND.—G. W. H. Rousl has entered into an agreement with the town trustees for the construction of an electric lighting plant. Mr. Roush will build and install similar plants in Algiers and Atwell, towns in Pike County.

RICHMOND, IND.—The Indianapolis, New Castle & Toledo Traction Company proposes to petition the City Council and the Board of County Commissioners for franchises to construct and operate street and interurban lines through Richmond and across the county.

FORT WAYNE, IND.—The Commissioners of Allen County have granted the Fort Wayne & Winona Interurban Company a franchise through the county and town of Arcola. This completes the right of way of the entire distance between this city and Winona.

ATTICA, IND.—Improvements are being made by the Attica Telephone Company. A new toll board is being installed, to which will be connected a number of new circuits reaching out into the surrounding country. A line has been built to Riverside and will be extended to Independence.

EVANSVILLE, IND.—A petition has been filed with the County Commissioners by property owners for an election to vote on a 1½-cent subsidy for the proposed Vanderburg & Posey Electric Railway Company, recently incorporated to build from Evansville to New Harmony, with a branch to Mount Vernon.

TERRE HAUTE, IND.—The Board of Public Works is said to have prepared a report, recommending that the contract with the water works company be cancelled on the ground that the service is insufficient for the needs of the city and fails to give stipulated fire pressure. It is understood that steps will be taken to build a joint water and electric light plant for the city.

CRAWFORDSVILLE, IND.—J. W. Farrell, in charge of an engineering corps, has begun the survey of the Crawfordsville & Northwestern Traction Company's line between Crawfordsville and Hoopeston, Ill., by way of Attica and numerous towns along the line. Spencer J. Hunt represents the capitalist building the road and is arranging to let the contract as soon as the survey is completed.

INDIANAPOLIS, IND.—It is understood that eastern capitalists plan to build an electric railway to connect Grand Rapids, Mich., with Indianapolis. It is proposed to touch South Bend, which has a connecting link with the Indianapolis Northern at Logansport.

VALLEY JUNCTION, IA.—The Hawkeye Telephone Company is planning improvements and extensions to its local system.

BOONE, IA.—The Boone County Telephone Company is planning to make extensive improvements to its system. The plans include about 20,000 feet of cable work.

DUBUQUE, IA.—The Dubuque, Iowa & Wisconsin Railway Company has raised the necessary $125,000 for the construction of its proposed interurban line of railway, and active steps toward the building of the road will probably be taken at once.

GARDEN CITY, KAN.—An electric road is projected to connect Garden City with Deerfield and Lakin.

ELLINWOOD, KAN.—A. H. Schaeffer is asking for a franchise for putting in an electric light plant here.

LEAVENWORTH, KAN.—James Stanton, of the firm of McGuire & Stanton, of this city, has just been granted a 20-year franchise to build a street railway in Coffeyville.

BELLEVILLE, KAN.—W. K. Palmer, consulting engineer, Kansas City, Mo., has secured the contract for engineering services in connection with the proposed municipal electric lighting plant for Belleville, Kan. Plans and specifications are in course of preparation at present in the office at Kansas City.

LINCOLN CENTER, KAN.—W. K. Palmer, consulting engineer, Kansas City, Mo., has been engaged as engineer in consultation with the firm of Burns & McDonnell, hydraulic engineers, to prepare plans and specifications for the municipal lighting plant for Lincoln Center, Kan. Plans and specifications are in course of preparation.

OWENSBORO, KY.—The contract for the erection of the new power house for the Owensboro City Railway Company has been let to Farnsworth & Hall, of Henderson, Ky. The power house will be erected on Sixth and Hathaway Streets.

DANVILLE, KY.—W. R. Meyers and associates have been granted a 20-year franchise for an electric lighting plant in Monticello, Wayne County, upon the condition that the work of installing the plant begin at once and be completed within six months.

MORGAN CITY, LA.—It is proposed to construct an electric light and power plant here at a cost of $25,000.

NEW ORLEANS, LA.—Because of the great increase in business within the past few years, the New Orleans Railway & Light Company is preparing to enlarge its Claiborne power house in order that the capacity of the generating machinery may be increased from 1,500 to about 3,000 horse-power.

NEW ORLEANS, LA.—St. Barnard will have an electric railway from the slaughter house to Borgnemouth. The franchise has just been sold to William J. Kelly, president of the Louisiana Lime Company and manager of the Lake Borgne Canal Company, who represents a number of Chicago and New York capitalists. Mr. Kelly states that he is not yet ready to make any announcement concerning the construction of the line, but gave out the positive assurance that work will begin in a short while.

DEXTER, ME.—W. E. Hazleton, superintendent of the Dexter Electric Company, states that C. H. Bachelder, of Dexter, was awarded the contract for constructing the new power house, bids for which were opened January 20.

ELLICOTT CITY, MD.—The contention over the lighting of Elkridge and vicinity has been settled by the commissioners notifying the Patapsco Electric & Manufacturing Company, which has the contract for furnishing the lights, to replace the incandescent lights with arc lights. The lights were formerly all arc lamps and were furnished by the United Electric Light & Power Company, of Baltimore, but when the contract was let last spring the Patapsco Company secured it and represented that they could light the section in question more satsfactorily by using smaller lights and increasing the number. The change was made, but did not prove satisfactory to the residents of Elkridge and vicinity, and the protests made resulted in the recent order.

LOWELL, MASS.—The Lowell Electric Light Corporation has petitioned for pole locations in various parts of the city.

ATTLEBORO, MASS.—Tappan Brothers are said to be contemplating the construction of a central light and power generating plant for the business section of Attleboro.

TEMPLETON, MASS.—A proposition to light the town, presented by the Rust Company, Providence, is to be given consideration, and the prospects for more light in the future are bright.

WESTBORO, MASS.—At a special town meeting, Melvin H. Walker, Richard F. Parker and John W. Slattery were appointed a committee to investigate and report as to the advisability of establishing a municipal lighting plant.

GREENFIELD, MASS.—The Greenfield Electric Light Company has held its annual meeting and the annual report presents a very favorable condition of the company's affairs. A portion of the system is to be reconstructed this coming season.

WESTBORO, MASS.—At a special town meeting held recently, a committee of three was appointed to investigate the matter of establishihng or acquiring a municipal lighting plant. The committee is composed of Melvin H. Walker, Richard F. Parker and John W. Slattery.

BELLINGHAM, MASS.—The Board of Selectmen have given a final hearing to the Edison Electric Light Company. After some changes the franchise was granted for the streets of Caryville and North Bellingham, according to the plans filed by the company. It is expected that the wires will be strung right away.

GREENFIELD, MASS.—D. J. Oakley, of Greenfield, is making a survey for a canal for the Lamson & Goodnow Co. at its storage reservoir on the Deerfield River some distance above Shelburne Falls village. The canal is for the purpose of drawing off the water in the reservoir, which has been of little use to the company. An electrical plant will probably be installed.

SAGINAW, MICH.—The Saginaw Electric Light Company has secured the contract for lighting Morrice, Bancroft and Perry. A power house will probably be constructed at Shiawassee.

DETROIT, MICH.—The Common Council has adopted the resolution appropriating $1,500 to enable the Public Lighting Commission to employ an expert to prepare plans for building a conduit or subway for all overhead electric wires.

BENTON HARBOR, MICH.—The St. Joe River Traction Company and the Southeastern Michigan Light & Power Company have filed articles of consolidation with the Secretary of State, under the name of the Benton Harbor-St. Joe Railway & Light Company, with a capital stock of $1,000,000.

GRAND RAPIDS, MICH.—The Central Michigan Railroad Company, it is reported, has been merged by sale into the Grand Rapids Electric Railway Company, which owns right of way for a line of railway from Grand Haven to Grand Rapids, thence through several other towns to Alpena. The purchase also includes a right of way from this city through Battle Creek, Coldwater and Camden in Michigan, to Pioneer, and other places in Ohio. Surveys have been made for 300 miles, 175 miles of which are graded. Jeremiah W. Boynton is president of the Grand Rapids Electric Company.

MANKATO, MINN.—The Mankato Gas & Electric Light Company has increased its capital stock from $225,000 to $500,000 for the purpose of making extensive improvements.

CASS LAKE, MINN.—W. G. Schroeder, of Bemidji, writes that it is proposed to construct a dam across the Mississippi River to develop power, which will be transmitted to Bemidji and Cass Lake. M. D. Stoner and E. Bourgeois, of Bemidji, are said to be interested. The probable cost of the proposed work is estimated at $20,000.

WESSON, MISS.—Citizens of Wesson are planning to build an electric railway to connect Wesson with the Mississippi Central Railroad. The power will be furnished by the Wesson electric light plant.

JACKSON, MISS.—The Jackson Street Railway, Light & Power Company has awarded to the Leonard & Martin Construction Company, Chicago, Ill., the contract for constructing its proposed new power house.

BILLINGS, MONT.—The franchise of the Billings Water Power Company expires during the present year. The plant supplies both water and light to the city. It is probable that the city will take steps toward installing a system of its own. Plans are being discussed, which include the construction of a headgate 15 or 20 miles up the river, with mains leading to reservoirs or settling basins to be placed high on the cliffs.

JACKSON, MO.—Bids will be received until February 19 by Mayor Edward D. Hays for furnishing material and installing a complete water and light plant for the city. Hiram Phillips, 615 Frisco Building, St. Louis, Mo., is consulting engineer.

ST. LOUIS, MO.—The St. Louis & Hillsboro Electric Railway Company, which is to construct a road from St. Louis to Hillsboro, is now arranging to finance a proposed extension of the road from Hillsboro to Bismarck. It is understood that the company has secured sufficient funds for constructing the road from St. Louis to Hillsboro and the work of building will be started next month.

GRAND ISLAND, NEB.—Plans, specifications and estimates of cost have been prepared by W. K. Palmer, consulting engineer, Kansas City, Mo., for a combined electric lighting and water works plant at Grand Island, together with a complete electric lighting system for this city. Plans and specifications are on file at Grand Island and at the office of the engineer at Kansas City.

LOVELOCK, NEV.—The citizens are in favor of installing an electric light system in connection with the new water works now being installed.

CAMDEN, N. J.—City Engineer L. E. Farnham is said to have estimated the cost of a lighting plant for supplying 602 arc lamps and 2,000 incandescent lamps at $127,000.

SEABRIGHT, N. J.—William Tabor Parker, of Little Silver, has been engaged in getting rights of way for the construction of an electric railway between Red Bank and Seabright. It is said that a spur from Seabright to Long Branch and Highland Beach may also be undertaken.

PASSAIC, N. J.—Assemblyman Wright has introduced a bill to enable the city to issue $100,000 bonds for the construction of a municipal electric lighting plant. The point has been raised that this amount would not be enough to construct such a plant as would be able to compete with the Public Service Corporation, and the question is creating a lively discussion.

CAMDEN, N. J.—Work has been started on a power house for the West Jersey & Seashore Railroad for the electric line to be constructed between Camden and Atlantic City. The Stirling Consolidated Boiler Company, which has the contract for installing 12 boilers in the power house, has begun work. The General Electric Company is drafting specifications for the generators.

SERGEANTVILLE, N. J.—The committee of farmers, composed of Wesley A. Bodine, D. O. Merrill and Frank W. Venable, all of this vicinity, is meeting with unexpected success in canvassing the property owners for rights of way for the proposed electric railway between Lambertville and Flemington. Practically all the rights of way will be donated, it is expected, or sold for a nominal figure.

SOUTH ORANGE, N. J.—The village of South Orange has decided to take steps toward establishing a municipal electric light plant for lighting the streets of the village and furnishing current to private consumers on the same plan as water is supplied to householders. The legislative committee of the village board of trustees has been instructed to proceed without delay to draw up a bill for introduction in the State Legislature which will give the village authority to construct and maintain a municipal plant. Lately the village authorities have been allowing the Public Service Corporation to lay conduits and do business in the village without a franchise or without its paying the village anything or even guaranteeing it against harm.

LANCASTER, N. Y.—The Village Trustees have granted a 5-year contract to Mr. Feyler for lighting the streets.

YONKERS, N. Y.—The Board of Aldermen have voted in favor of the city owning, equipping and operating a municipal electric light plant.

JAMESTOWN, N. D.—The Northwestern Telephone Exchange Company is contemplating an extension of its service to Spiritwood Lake.

SHARON, N. Y.—The Shenango-Midland Street Railway Company is planning to construct seven miles of road in the vicinity of Sharon.

BROOKLYN, N. Y.—The Board of Aldermen has passed an ordinance for an issue of corporate stock to the amount of $175,000, as authorized by the Board of Estimate for placing electrical conductors underground in Brooklyn.

UTICA, N. Y.—Announcement has been made by the Central New York and Empire State Telephone Companies, that jointly they will expend $1,500,000 in 18 counties this year. A sum of $200,000 will be set aside for the establishment of the stations and the rest of the amount will be devoted to extending subways and otherwise developing the existing system. The Central New York Company will spend from $35,000 to $50,000 at Utica, mostly in subways.

BROOKLYN, N. Y.—A plan for a municipal electric railway in the eastern district of Brooklyn and Greenpoint has been inaugurated by Borough President Coler. The scheme may be the means of relieving one of the congested parts of the eastern district, and if carried out, will establish a direct electric railway from Queens County to the Borough of Manhattan. It embodies the extension of Grand Street and the opening of an electric railway into one of the rapidly growing sections of Queens Borough.

LYONS, N. Y.—At the quarterly meeting of the Wayne-Monroe Telephone Company, General Manager John A. Driscoll presented the quarterly report of the company, showing net earnings of the quarter to be at the rate of 12 per cent on the capitalization of $200,000. Director Kelley secured the adoption of a resolution to expend part of the surplus under direction of President Dirscoll in extending toll lines.

CARRINGTON, N. D.—A bond issue of $10,000 has been voted by the citizens for the construction of a municipal electric light plant.

NEWARK, OHIO.—The Licking Electric Light & Power Company, of this city, in which a number of Columbus parties are interested, has decided to erect a new power house at a cost of about $100,000.

COLUMBUS, OHIO.—The Fairfield Traction Company has filed an amendment to its charter, which provides for the construction of an electric railway from Lancaster to Millersport, on Buckeye Lake.

MT. VERNON, OHIO.—An ordinance has been prepared and introduced at the Council proposing that the city issue bonds in the sum of $35,000 for the purpose of building and operating a municipal electric light plant, and that the matter of the bond issue should be submitted to a vote of the people on March 20.

DELAWARE, OHIO.—The stockholders of the Citizens' Telephone Company at their annual meeting re-elected the board of directors. It was decided to build more lines. The financial report showed the finances of the company to be in excellent condition. At the beginning of 1905 there were 1,321 telephone in service and during the year 347 were installed. Seven years ago the company was started with 150 telephones.

STROUD, OKLA.—The election to vote for bonds for the construction of water works and an electric light plant was carried by a large majority. The plants will be operated by the city.

WATONGA, OKLA.—M. A. Earl, consulting engineer, of Muskogee, I. T., writes that the date of opening the bids for constructing an electric light plant and water main extensions at this place has been extended. The bids were to have been opened on February 9. G. E. Moore is City Clerk.

SHAWNEE, O. T.—The City Council here has under consideration the matter of granting a franchise to the Shawnee Lighting Company for a period of twenty-one years. D. T. Flynn is president of the company. It looks as if the franchise will be granted. The new franchise reduces the price of incandescent lights from 25 cents to 15 cents and of arc lights from $8 to $7 per month.

McMINNVILLE, ORE.—H. S. Maloney, City Recorder, writes that bids for the construction of the electric light plant have not yet been called for. The probable cost of construction is estimated at $13,000.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company is considering plans for the entire remodelling of the system. It is proposed to install the central energy system, and the overhead steel wires will be replaced by copper wires. The cost of the proposed improvements is estimated at $250,000.

THE DALLES, ORE.—The Interior Development Company has made a filing on water to be taken from Deschutes River, near Shearer's bridge, about 30 miles from the mouth of the river. It is the purpose of the company to take the water out of the river at the point where it has made its filing and carry it in flumes about two miles, which will give it a fall of some 50 feet, and there establish a hydro-electric power plant. The power plant at White River, owned by the Wasco Warehouse & Milling Company is now taxed to its full capacity, furnishing light and power for The Dalles and Dufur, and there is a good field for another plant.

HARRISBURG, PA.—Mayor Gross has signed the belt line ordinance of the Central Pennsylvania Traction Company. Construction work will begin in the spring.

DANVILLE, PA.—The Danbury & Sunbury Electric Railway Company has been granted an extension of its charter, which gives it the right to extend its line from Danville to Catawissa.

MONONGAHELA, PA.—Surveyors are now at work on the West Shore trolley line to be constructed between Donora and Black Diamond, and the assurance is given that the road will be rushed to completion.

WILKESBARRE, PA.—The Wilkesbarre & Hazleton Railway Company states that as soon as it receives permission from the Council, it will begin the construction of the proposed extension to Ashley.

DUNLO, PA.—Samuel Lemhart and Dr. C. E. Hannon, of Johnstown, and John Powers, of this city, are reported to have purchased the plant of the Dunlo Electric Light Company and will extend the system to Llanfair and Salix.

DOYLESTOWN, PA.—The Perkasie, Doylestown & Newhope Railway Company's ordinance for a right of way through certain streets in this borough was passed by the Common Council at its last session and will doubtless be accepted by the company.

LANCASTER, PA.—Construction work on the Philadelphia, Coatesville & Lancaster Electric Railway, now in operation between Coatesville and Parkesburg, is to be resumed in the early spring. It is expected to have it in operation as far as Atglen by mid-summer. The line will ultimately be built to Lancaster.

MEDIA, PA.—The Media, Middletown & Aston Electric Railway Company expects to extend its lines to Village Green and Rockdale, where connection will probably be made later on with a branch of the Philadelphia & West Chester Traction Company's line, which it is expected will be built at an early date.

NEWTOWN, PA.—The route of the proposed extension of the New Jersey & Pennsylvania Traction Company's line from this borough to Hatboro and Willow Grove has been practically decided upon, and it is expected that work will begin in the spring. When completed to Willow Grove this will afford the most direct and quickest connections between Trenton and Philadelphia, though not the shortest line.

MECHANICSBURG, PA.—The Secretary of the Borough Council writes that all bids received for lighting have been returned unopened and that nothing further will be done until the reorganization of the Council in March.

READING, PA.—Thomas Searles, of Pottstown, and Cyrus Q. Guldin, of Reading, representing a syndicate, recently purchased the property of the Ringing Rocks Electric Railway Company, for $23,000 at public auction. In addition to the $23,000, the purchasers will have to satisfy a $4,000 mortgage and about $1,000 interest. This company was originally formed by twenty residents of Pottstown, with a capital stock of $50,000, and the line was opened June 15, 1894. Inability to complete the system by extending lines to Swamp and Boyertown in order to get a suitable terminus has always handicapped the corporation. After title has been passed on February 16, it is the intention to reorganize the company under the name of either the Ringing Rocks Traction Company or the Montgomery line to Boyertown, there to connect with the system of the United & Berks Traction Company. It is then the purpose to extend the Traction Company.

COLUMBIA, S. C.—The Columbia Street Railway, Light & Power Company is having plans drawn for a handsome new power plant, and the architects will be ready with their specifications in a short time. The new power house will be located on the banks of the canal near the city.

ABERDEEN, S. D.—It is rumored that the citizens and business men of Watertown have raised a bonus of $200,000 for the northwestern extension of the Minneapolis & St. Louis Railway from Watertown, provided the road runs up to Groton instead of Aberdeen.

COLUMBIA, S. C.—Application has been filed here for a charter for the Augusta & Columbia Railway Company, which is a definite step toward the long-talked-of extension of the Augusta-Aiken electric railway to Columbia. The applicants are James U. Jackson, general manager of the Augusta-Aiken Railway & Electric Company, and others. The new corporation proposes to take over the Augusta-Aiken line, 23 miles long, connecting Augusta, Ga., and Aiken, S. C., and to build 52 miles of road into Columbia. It asks for authority to use steam or electricity as motive power.

MIDDLEBROOK, VA.—The Virginia Valley Traction Company held its annual stockholders' meeting last week in Staunton and elected the following officers: J. Frank Clemmer, president; J. M. Smiley, first vice-president; P. H. Hantsch, second vice-president; H. G. McGary, secretary and treasurer. The capital stock will be increased from $100,000 to $250,000. It is intended to push the enterprise to completion.

BRADFORD, VT.—The power plant of the Bradford Electric Lighting Company has been put in successful operation and Bradford and Newbury are now lighted from the new plant. The plant is run by water power and its present equipment has a capacity of 5,000 lights. Negotiations are under way with the neighboring villages of Haverhill, North Haverhill and Fairlee to supply current for light and power, and it is probable that the necessary extensions will be made.

SEATTLE, WASH.—Plans are said to be in course of preparation for the erection of a sub-station for the Fremont District of the city lighting department.

SPOKANE, WASH.—The Rockford & Mount Hope Telephone Company has applied for a franchise to construct, operate and maintain telephone lines on the county roads near Rockford.

OLYMPIA, WASH.—The management of the Olympia Light & Power Company announces that the company is enlarging its plant to a capacity of 3,000 hp. The improvement will be completed this coming fall.

COLUMBIA, WASH.—A telephone franchise has been granted to the East Mill Plain Telephone Company. The line will start east of Vancouver Barracks and follow the Mill Plain road, with branches running to Fisher's Landing and the Harmony neighborhood.

CHEYENNE, WYO.—Plans are being discussed for the formation of a company for the purpose of purchasing and combining the electric power plant at Boulder with others in the larger towns in northern Colorado. William J. Barker, of the electric department of the Denver Gas & Electric Company, and Joseph J. Henry are the Denver representatives of the syndicate, which, it is said, will be prepared to spend $2,500,000 in carrying out its plans. It is also proposed to build an electric railway from Denver to Cheyenne, Wyo.

VANCOUVER, B. C.—The British Columbia Railway Company is preparing the site for its new sub-station and car barns, bids for which will be invited immediately.

PORT ARTHUR, ONT.—The Town Council has made application to the provincial legislature for permission to build a belt line street railway through the residential portion of the town.

FORT WILLIAM, ONT.—It is said that $12,000 will be expended this year in improving the telephone system of Fort William.

OTTAWA, ONT.—The improvements which the Ottawa Electric Railway Company intends making at Britannia-on-the-Lake will include the extension of the pier, erection of a club house and the enlargement of the auditorium.

ST. JOHN, N. B.—The sub-committee of the Safety Board has decided to employ Ross & Holgate, of Montreal, Que., to prepare estimates for the construction of a lighting plant for the streets and public buildings. An estimate will also be prepared for procuring water power from Silver Falls.

ST. JOHN, N. B.—At the annual meeting of the Maine & New Brunswick Power Company, at St. John, January 23, it was decided to begin work at once on the construction of a dam, and it is expected that by November 1 power will be supplied to Andover, Perth, Florenceville and other points on the St. John River. J. D. Seely, of St. John, is secretary of the company.

ALBUQUERQUE, N. M.—The Colorado Telephone Company is planning to erect a new building. The line between Denver and this city is nearly completed.

ESTANCIA, N. M.—The Board of Trade at its last meeting took up the matter of organizing a company for the purpose of building a local telephone system. A committee consisting of J. W. Corbett and N. S. Rose was appointed to look into the matter.

CARBERRY, MAN.—The Town Council is reported to be considering the question of constructing an electric light plant.

WINNIPEG, MAN.—The date of opening of bids for supplying two 500-hp electric generators has been extended from February 12 to February 26. Address all bids to Alderman J. C. Gibson, Chairman of Fire, Water and Light Committee.

WINNIPEG, MAN.—C. Chamberlain, manager of the Great Falls Power Company, of Manitoba, states that it is proposed to develop at present 50,000 hp, which may be increased ultimately to 150,000 hp. The cost of the work will be about $3,000,000. Bids for construction will probably be received about March 15.

New Incorporations.

LITTLE ROCK, ARK.—The Ozark & St. Paul Telephone Company has been incorporated with a capital of $3,000 by A. C. Blaylock and others. They will construct and operate a telephone line in the northern part of Franklin County and the southern part of Madison County.

COLORADO SPRINGS, COL.—The Empire Water & Power Company has filed articles of incorporation, stating its capital stock to be $1,000,000. The company will construct reservoirs above Green Mountain Falls, the power thus secured to be used for manufacturing, lighting and other purposes. William A. Otis and George A. Taft are among the incorporators.

NAMPA, IDAHO.—A recent concern to file a certificate of incorporation is the Dewey Electric Light & Power Company, having a capital stock of $1,000,000.

BLUFFTON, IND.—Articles of incorporation have been prepared by Attorneys Merriman & Dailey for the Tocsin Telephone Company, the incorporators of which are Henry Plummer and A. P. and C. K. Kelley. The company's capital is $10,000.

CHICAGO, ILL.—The Block Light Company has been incorporated here with a capital of $1,000. Russell Wiles is among those interested in the new concern.

KINSMAN, ILL.—W. D. Lindsay, Thomas Drinan and E. J. Phelan recently filed articles of incorporation for the Kinsman Independent Telephone Company, capitalizing it at $2,500.

SPRINGFIELD, ILL.—The Patterson-Stewart Company, of this city, has been incorporated for the purpose of conducting a heating and lighting business. The company is capitalized at $10,000. Frank U. Patterson is one of the incorporators.

CHARLESTON, ILL.—The Mattoon, Shelbyville, Pana & Hillsboro Traction Company has been incorporated and its principal office will be located in this city. The company is capitalized at $10,000, and will construct a line from Mattoon to Hillsboro. W. T. Craig and W. T. Patton are among the incorporators.

SPRING GROVE, ILL.—The Spring Grove Telephone Company, with a capital of $10,000, has been incorporated by Joseph E. Meredith, Anton Schaefer and Henry C. Sweet.

EL PASO, ILL.—The Grand Telephone Company has been incorporated with a capital of $1,100. The incorporators are E. P. Armstrong, J. C. McGraw and C. A. Gull.

JASONVILLE, IND.—The Indiana Electric Transmission Company has filed its certificate of incorporation, indicating its capital stock to be $250,000, and naming the following directors: Thomas Duncan, Howard L. Hyatt and William H. Hornberger. The company will build and operate an electric plant to furnish heat, light and power in Jasonville, Coalmont and Hymera, and also to the coal mines.

GARNETT, KAN.—The Garnett Telephone Company has been incorporated, with a capital stock of $25,000.

HUTCHINSON, KAN.—The Hutchinson Interurban Railway Company has been incorporated and is capitalized at $100,000.

NEW CAMBRIA, KAN.—The New Cambria Telephone Company, with a capital of $5,000, has filed articles of incorporation.

LAKE BENTON, MINN.—Articles of incorporation have been filed by the Lincoln County Telephone Company, stating its capital stock to be $50,000.

MILLBROOK, N. Y.—The Northern Electric Railway Company has been incorporated with a capital of $600,000. The following are the directors: E. H. Rippee, Jr., C. C. Ferber and F. L. Fuller.

TROY, N. Y.—The Champlain Valley Traction Company was formed at a recent meeting held at Middleburg, Vt., for the purpose of constructing and operating a trolley line. The proposed road will run from Vergennes to Fair Haven and will be equipped for both passenger and freight service.

NORWOOD, N. C.—The Norwood Electric Light Company is reported to have been incorporated with a capital of $25,000, by J. N. Lilly and others.

CLEVELAND, OHIO.—The Oliver Electric Company, with a capital of $10,000, has been incorporated by E. C. Mullen, A. H. Parrott, H. A. Mullen, Sherman Arter and M. Barnes.

XENIA, OHIO.—The Columbus & Miami Valley Railway Company, of this city, has been incorporated by G. Dennis, W. H. Thompson, J. M. Dawson, Charles Follett and J. M. Jones.

TOLEDO, OHIO.—The Toledo & Columbus Electric Railway Company has been organized with the following officials: D. H. James, president; William Finlay, vice-president; H. R. Klauser, treasurer, and Mark Winchester, secretary.

LAMONT, OKLA.—The Deer Creek & Lamont Telephone Company has filed articles of incorporation. The company is capitalized at $1,200.

WEATHERFORD, OKLA.—The Northern Mutual Telephone Company, with a capital of $3,000, has been incorporated by W. S. Wood, Joseph Wolverton and W. A. Coddington.

OREGON CITY, ORE.—W. H. Bonney, C. G. Huntley, Dr. H. S. Mount, E. G. Caurield have incorporated the Oregon City & Farmers' Independent Telephone Company, with a capital stock of $5,000.

PORTLAND, ORE.—The Standard Heat & Power Company, having a capital of $5,000,000, has been incorporated by M. W. Baldwin, J. J. Herman, J. L. Brophy, W. F. Crummett and H. E. Mason. M. W. Baldwin is president and J. J. Hernan, treasurer.

HAZLETON, PA.—The Consumers' Electric Light & Power Company has been organized and will soon apply for a charter to construct an electric light plant in Hazleton. David Benjamin, James H. Loughran and Harry A. Mohr are among those interested in the new company.

HITCHCOCK, S. D.—The Pioneer Rural Telephone Company has filed articles of incorporation with a capital of $5,000.

LILLY, S. D.—The Lilly Local Telephone Company has been incorporated, with a capital of $3,700 and will conduct a local telephone business.

MENNO, S. D.—Articles of incorporation have been filed for the Menno Rural Telephone Company by G. W. Munsmer, H. H. Claggett and Peter Gudmunson. The company has a capital of $25,000.

BELLE FOURCHE, S. D.—The Belle Fourche Electric Light, Heat & Power Company has been incorporated with a paid-up capital stock of $25,000. A. A. Moody is president, and T. H. Gray, vice president, of the new concern.

MEMPHIS, TENN.—The Memphis Electric Company was recently incorporated with a capital of $5,000.

READSBORO, VT.—The Readsboro Electric Light Company has filed articles of incorporation, showing a capital stock of $2,000.

STANDWOOD, WASH.—The Stanwood Light & Power Company has been incorporated with a capital of $4,000.

SEATTLE, WASH.—Articles of incorporation of the Montana Miners' Electric Railway & Power Company have been filed by W. A. Sharp, of Tacoma; A. J. McCorkle, of Libby, Mont.; H. W. Leuders, of Tacoma; H. H. Howard, of Auburn; C. R. Fairman, of Tacoma. The capital stock of the corporation is given at $150,000. Seattle is to be the principal place of business. The incorporators are named as trustees.

BELOIT, WIS.—The articles of incorporation for the Beloit Water, Gas & Electric Light Company have been filed. The company is capitalized at $600,000 and is a consolidation of the water, gas and electric power plants. The new company, it is said, will expend about $200,000 in improvements and extensions.

New Industrial Companies.

THE ELECTRICAL SUPPLY & FIXTURE COMPANY, of Long Beach, Cal., has been organized by E. A. Wilson, A. A. Towne and George L. Curtis. The company has an operating capital of $25,000.

MERCHANTS' ELECTRIC PROTECTION COMPANY, of Chicago, has been incorporated by T. B. Hall, A. White and W. J. Creighton. The company will manufacture and install automatic signal systems.

THE CONSTENTINE STORAGE BATTERY COMPANY, of New York, has filed articles of incorporation. Its capital stock is $8,000, and the following are named as directors: E. B. Constentine, W. H. Smith and J. A. MacEwan.

THE BOSTON LIGHT & EQUIPMENT COMPANY, of East Orange, N. J., will make a business of equipping buildings and establishments for lighting. The company has a capital of $250,000. J. P. Crosby is among the promoters of the enterprise.

THE MEIGS COUNTY HOME TELEPHONE COMPANY, of Pomeroy, Ohio, has filed articles of incorporation, with a capital of $50,000. The incorporators are Arthur B. Kratz, C. E. Peoples, George Schwegman, O. A. Rowley and W. E. Stansbury.

THE ARC SPARK MANUFACTURING COMPANY, New York, has been incorporated and will manufacture automobile sparking plugs. The company is capitalized at $10,000, and the following comprise the board of directors: K. C. Wideen, C. J. Pearson and F. T. H. Bacon.

THE AMERICAN ELECTRIC CONSTRUCTION COMPANY, of Chicago, Ill., has been organized with a capital of $2,500, and will manufacture insulation and other electrical supplies. The company was incorporated by Henry Martin, William H. Duval and Alice E. Gorman.

THE LAUBE ELECTRICAL COMPANY has filed its articles of incorporation and will commence operations on a capital stock of $15,000. E. M. Beuhl, Charles A. Laubenbeiger and Cleveland Babcock are the incorporators. The company is located on Elm Street, Buffalo, N. Y.

ENGINEERING OF LIGHT & ILLUMINATING COMPANY, of New York City, has filed articles of incorporation and will engage in the manufacture of apparatus for light, heat and power. The company is capitalized at $20,000, and is incorporated by A. A. Ernst, Edgar Beekman and Cornelius C. Beekman.

LAFAYETTE, IND.—The Indiana Electric Transmission Company has filed articles of incorporation, capitalized at $250,000. It is the purpose of the corporation to operate in Sullivan County and furnish heat, light and power to Jasonville, Coalmont and Hymera. Power and light will also be furnished to the extensive coal mines tributary to these towns. The incorporators are Howard L. Hyatt, William H. Hornberger and Thomas Duncan.

Legal.

FESSENDEN LIQUID BARRETTER.—Action has just been taken by the United States Circuit Court for the Southern District of New York in enjoining the Wireless Telegraphy Company, Limited, of Berlin, Germany, known there as Gesellschaft fur Drahtlose Telegraphie, m.b.H., from infringing letters patent of the United States, Reissue No. 12115, granted to Reginald A. Fessenden, May 26, 1903. It will be remembered that Judge Wheeler filed an opinion on October 16, 1905, upholding the validity of this patent and adjudging it infringed by the American De-Forest Wireless Telegraph Company and others and directing a decree for an injunction and an accounting. The opinion was noted in this paper at the time. The injunction now issued restrains the German Company, which it was alleged had been importing the apparatus from Germany and selling it to the Goverment under the name "Slaby Arco System," "Telefunken System," etc., from further making, using or selling the infringing apparatus and "also especially from the manufacture, use and sale of the three forms of device referred to in said morning papers, namely, first, the adjustable silver-coated platinum wire form; secondly, the silver-coated platinum wire sealed in glass form, and, thirdly, the platinum wire sealed flush in glass form."

OLD TELEGRAPH SUIT.—Judge Hazel, in Buffalo, has rendered a decision in favor of Thomas A. Edison in a suit brought nearly thirty years ago against Jay Gould. Originally damages were asked in the sum of $300,000. The suit hinged upon the refusal of Gould to pay for patents sold to the Automatic Telegraph Company, of which the Western Union is the successor. It is charged that for thirty years this latter company has been using devices owned and patented by Mr. Edison. The litigation in all probability is not ended yet, as this is not a decision by a court of last resort.

RULES ON TELEGRAPH BLANKS.—Last week a jury in Part II of the Supreme Court, Brooklyn, decided that a telegraph company is responsible for damages when in transmitting a message intrusted to it the company makes a mistake. The sum of $2,200, the full amount sued for, was awarded E. S. Halstead & Co., bag manufacturers in Manhattan, against the Postal Telegraph Company. A message was sent by Armour & Co., of Chicago, to Halstead & Co., inquiring the price on a contract for 25,000 bags. Before replying the plaintiff telegraphed to the Cannon Manufacturing Company in Concord, N. C., for prices on cloth for the bags. Replying, the Cannon Company gave 3.80 cents a yard for wide material and 2.80 cents for narrow cloth. This message when received by the Halstead concern read 3⅛ and 2⅛ cents a yard. The total difference on the contract was $2,200. As soon as the message was received the contract was accepted, and the bag-making company was compelled to stand the loss. It is said the case will be carried to the Court of Appeal, and possibly to the United States Supreme Court, as the company claims that the printed notice on the back of each telegraph blank exempts it from responsibility for any mistakes in transmission of messages.

INJURY FROM WIRE.—The Supreme Court of Michigan, in the action of Stark versus the Muskegon Traction & Lighting Company has affirmed the decision of the lower court in favor of the defendant. The main points were: (1) Negligence of an electric light company in violating an ordinance requiring wires to be strung 25 feet above the ground will not be presumed to have caused or contributed to an injury to a child who came in contact with a loose telephone wire, which had been thrown over the wires of the light company. 2. The fact that a child who seized a telephone wire, suspended over a defectively insulated electric light wire, was not aware of the danger of so doing, is not sufficient of itself to charge the electric light company with responsibility for injury to the child. 3. Electric light wires were suspended only 19 feet above the ground, whereas the city ordinance required them to be suspended 25 feet above the ground. There was also evidence of their defective insulation. Plaintiff, a boy 10 years of age, was playing with other children on the ground beneath the wires, when a telephone wire, strung on the same posts with the light wires, became broken and was thrown by one of the children over the light wires, where it came in contact with defective insulation. Plaintiff took hold of the telephone wire in order to experience the shock which another boy had received and to show his valor, and was injured. Held, that neither the defective insulation nor the distance of the wires from the ground was the proximate cause of the injury to plaintiff, but such injury was the result of his own wrongful interference with the wires.

Obituary.

MR. THEODORE SPENCER, vice-president and general manager of the Bell Telephone Company, of Philadelphia, and of the Delaware & Atlantic Telegraph & Telephone Company, died of acute Bright's disease, January 28, at his home in Philadelphia. He was born at Fort Snelling, Minn., in 1870. Mr. Spencer graduated from the Massachusetts Institute of Technology in 1891 as an electrical engineer, and after a short service with the General Electric Company at Lynn, Mass., entered the employ of the American Bell Telephone Company in Boston. In 1894 he came to Philadelphia in the same employ, first as superintendent of installation, afterward becoming successively engineer, general superintendent and general manager. Recently he was made vice-president and one of the directors. It was largely through Mr. Spencer's ability that the Bell Telephone Company, of Philadelphia, has reached its present development. He is survived by a widow and two children.

Educational.

WORCESTER POLYTECHNIC.—A new electrical engineering building will shortly be erected at the Worcester Polytechnic Institute, on the grounds immediately north of the Salisbury Laboratories. The architectural features will be such as to provide for an attractive addition to the notable buildings of Worcester. For some time the Salisbury Laboratories have been overcrowded by the physics, chemistry and electrical departments, and the construction of the building will bring much relief. The new building will contain the usual recitation rooms and laboratories, including as special features a lecture room capable of seating 300 persons, a standard laboratory fully equipped, a department library and reading room with a stack capacity for 2,000 volumes, a design room, photometric, high potential and electric railway engineering laboratories. The electric railway laboratory will be equipped on a scale which will enable both theoretical investigations and practical tests to be made with the utmost facility.

UNIVERSITY OF WISCONSIN LECTURES.—Announcement has just been made by the College of Engineering University of Wisconsin, of the complete list of non-resident lectures who are to address the students in engineering during the coming year. The lectures selected include some of the most prominent authorities on special phases of engineering in the country. The lectures are not confined strictly to engineering topics, but include the consideration of various industrial and commercial problems with which the engineer is brought in contact. Among the subjects pertaining to electricity, "High Speed in Modern Engineering" will be discussed by Mr. B. A. Behrend, chief electrical engineer of the Allis-Chalmers Company.

Personal.

MR. A. C. GARRISON, president of the Columbia Incandescent Lamp Company, of St. Louis, was a visitor to New York City last week.

MR. A. E. WINCHESTER, the superintendent of the municipal electric light plant at South Norwalk, Conn., has been unanimously elected chief of the fire department of that city, and took office February 1.

MR. W. A. BIXBY has tendered his resignation as manager of the Quincy Gas & Electric Company, Quincy, Ill., to accept the general managership of the properties headed by George B. Macomber, of Portland, and popularly called the "Main Syndicate," which are located at and near Springfield, Mo.

MR. WARREN P. BRISTOL, general manager of the Meriden Electric Railway, of Meriden, Conn., has been appointed acting general manager of the Hartford lines of the Consolidated Railway Company, to succeed Mr. Frank Caum, who has accepted the position of general manager of the Scranton Railway.

MR. JAMES A. STORER, after eighteen years of service, has severed his connection with the Richfield Springs Electric Light & Power Company. Mr. Storer has ably filled the post of general manager for the company, but his various other interests now occupy so much of his time that he has decided to give up this responsibility.

MR. WARREN BICKNELL has retired as president of the Lake Shore Electric Railway Company, to become president of the Cleveland Construction Company, with offices in Cleveland, Ohio, succeeding Mr. Will Christy. The company makes a business of building and financing properties and is now identified with several important projects.

PRESIDENT F. P. FISH, of the American Telephone & Telegraph Company has just returned from a trip, covering three weeks, to the Pacific Coast. He made a careful investigation into the affairs of the Pacific States Telephone Company, and was greatly pleased with the telephone development in the Far West, the Pacific Coast territory of the company showing 200,000 telephones, or 1 to every 12 of the population.

MR. JOHN F. GILCHRIST has been appointed by President Blood of the National Electric Light Association, as reporter on the "Installation of Electric Signs Free." Mr. Gilchrist's large experience with the Chicago Edison Company will enable him to prepare a very interesting and instructive report on this subject for presentation at the twenty-ninth convention of the association, to be held at Atlantic City, N. J., June 5, 6, 7 and 9 next.

GEN. EUGENE GRIFFIN, first vice-president of the General Electric Company, has been elected a member of the board of trustees of the Engineers' Club, New York City, to serve for a term of office expiring 1910. General Griffin has been a member of the club for some years, and when he took his volunteer engineer regiment to Porto Rico, was presented by the club with a stand of colors, now preserved in the club house since the regiment's return.

MR. JAMES B. OLSEN, manager of sales of the India Rubber & Gutta Percha Insulating Company, has just returned from Chicago, where he made a great success of the handsome exhibit of his company in the Electrical Show. He speaks enthusiastically of the Show as a success financially and in many other ways and says it has been a splendid educational factor locally. As to the business outlook, Mr. Olsen, who is a close, shrewd judge, says it is excellent, and that trading, although enormous, is on a sound basis. Orders and inqnuiries run into very large figures.

MR. W. K. PALMER, consulting engineer, Kansas City, Mo., has established a branch office in Memphis, Tenn., at 52 Porter Building. Mr. L. C. Wilson, formerly chief engineer of the office in Kansas City, is in charge of the Memphis office, which is directing the construction of an important plant for the Standard Box Company at Memphis. The office is equipped with all the necessary facilities for the engineering work connected with power plants and factory construction in the southern territory.

MR. E. F. CANNON, president of the E. F. Cannon Company, Portland, Oregon, has sufficiently recovered from a month's illness to enable him to depart for the Hawaiian Islands. Mr. Cannon will sail on the steamer "Mongolia" from San Francisco, Feb. 6, to be absent three or four months. The after effects of a severe attack of "Pyemia blood poison," which Mr. Cannon passed through in 1900, left his constitution in a shattered condition from which he has never fully recovered. Mr. Cannon has decided to spend his winter months in a more temperate climate.

MR. D. E. EVANS.—At a meeting of the directors of the Maryland Telephone Company, Baltimore, last week, Mr. H. W. Webb resigned as president and Mr. David E. Evans, vice-president, was elected to fill the vacancy. Mr. B. S. Joslyn was chosen vice-president to succeed Mr. Evans. In addition to resigning the presidency, Mr. Webb resigned from the Board of Directors, and Mr. Joslyn was elected in his place. Mr. Webb also resigned as vice-president and director of the Baltimore Electric Power Company, and Mr. Joslyn succeeded him there. Mr. Joslyn, the new vice-president of the company, is a Philadelphian, and represents the Philadelphia interests in the company. He has been in the president's office about three months. Mr. Evans is a veteran in the electric lighting field in Baltimore, where he was once connected with the old Brush interests, and he is widely known in the electrical field.

Trade Publications.

THE NATIONAL CARBON CO., of Cleveland, O., has issued a very attractive calendar for 1906, following its accustomed plan. Interleaved in the monthly calendar pads are terse and forceful advertisements of the National products.

ELECTRICAL SUPPLIES.—The United Electric Company, Wichita, Kan., is distributing the first of a series of blotter calendars for 1906, calling attention to its complete stock of electric and telephone supplies, the assortment and quality of which are stated to be equal to those of any supply house in the West.

INDICATOR COCK.—The Schaeffer & Budenberg Manufacturing Company, 66 John St., New York, has issued an illustrated pamphlet devoted to a four-way indicator cock which has been designed as a convenient means of taking cards from the throttle and exhaust-pipe line, as well as from the receiver space of compound engines.

ELECTRICAL CONSTRUCTION SUPPLIES.—Catalogue No. 555 of the Fletcher Manufacturing Company, Second and Canal Streets, Dayton, Ohio, is a 60-page publication devoted to electrical construction supplies, including wire holders, automatic suspension pulleys, sleet-proof pulleys, windlasses, mast arms, iron pins and brackets.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY, manufacturers of Habirshaw wires and cables, 13-15 Cortlandt St., New York City, Mr. J. B. Olson, sales manager, has just issued a very dainty and pretty line of blotters, of the Indian Maiden and Floral type, each bearing the monthly calendar. Like the wires and cables they are good to have around the place.

COLUMBIA UNIVERSITY, N. Y.—The 1906 catalogue of Columbia University shows the total number of officers of administration and instruction to be 573, and the total number of resident students 4,755, as against 4,833 last year. These figures do not include the extension students, of whom there are nearly one thousand.

SHEET-METAL ROOFING.—In a well-prepared publication having the title "Roofing Rules," the Merchant & Evans Company, Philadelphia, Pa., presents in a plain and simple form the various points about metals in building construction. In addition to describing the various materials used for roofing, and the method of manufacturing them, numerous instructions are given for constructing a metal roof.

INTERIOR ILLUMINATION.—The General Electric Company, Schenectady, N. Y., has issued as bulletin No. 4,431, a well-illustrated article discussing illuminating engineering as applied to interior lighting, which serves to show the desirable features of the concentric diffuser and the light balancing selective diffuser ceiling. These improvements used with arc lamps make the illumination obtained ideal for interiors.

THE PIRELLI FACTORY.—The journal *L'Automobile*, of Milan, Italy, contains an illustrated description of the Pirelli factory in that city, devoted to the production of insulated wires and cables, as well as automobile tires and rubber goods of all kinds. The establishment is one of the largest of the kind in Italy and in all Europe. Dr. Alberto Pirelli, of the firm, is well known and a frequent visitor on this side of the Atlantic.

INCANDESCENT LAMPS.—Publication S. M. 4002 of the Sawyer-Man Electric Company, New York, is an attractively illustrated catalogue dealing with incandescent electric lamps for all kinds of service. In the standard lamps the filament is anchored to the mount so that when necessary the lamp may be burned in any position without excessive drooping. Lamps of this design are made in sizes from 2 to 50 candle-power, and for from 0 to 130 volts. Each lamp which is intended for from 190 to 250 volts has a double-coil filament, doubly anchored to the mount. Lamps of from 45 to 60 volts have short, thick filaments which do not require supports. For lighting a limited area at a minimum cost for power, a filament consuming 35 watts is given a double-coil form and placed in a door-knob shaped bulb, which is silvered in such a manner as to reflect all the light directly downwards giving 28 candle-power over an area 8 feet in diameter. It will be noted that in effect the consumption corresponds to 1.25 watts per candle. This lamp is exceedingly economical and satisfactory for places where all the light is required directly at the work. The use of frosted lamps is recommended, particularly in connection with handsome electroliers, side brackets, ceiling fixtures and for general illumination, from the fact that it results in more evenly diffused and more pleasant light. The light emitted from the incandescent filament in any direction is in proportion to the surface of the filament exposed in that direction, and for the small surface of the filament it is intense. By frosting the lamp the whole surface of the bulb becomes the radiating surface, without appreciably decreasing the total volume of light emitted from the filament, and the light is rendered softer and more agreeable.

HIGH-SPEED LATHES.—A well-executed publication, designated as Catalogue No. 59, devoted to high-speed lathes, has just been received from the Tangye Tool & Electric Company, Limited, Birmingham, England. These lathes have been designed expressly for use with high-speed steel tools. In order to overcome the troubles encountered in high-speed operation, each lathe is equipped with a single-pulley headstock. This headstock has no cone pulley, but is provided with a single pulley carried on a side shaft, and the changes in speed can be quickly made. This construction removes the pull of the driving belt from the spindle to a separate shaft running in long gun-metal bearings with oil-ring lubricators which will work for long periods without attention. The catalogue contains numerous illustrations of special, high-speed and electrically-driven machine tools.

STORAGE BATTERY FOR REGULATION.—Bulletin No. 6 of the Gould Standard Battery Company, 1 West 34th St., New York, gives a complete description of the battery installation of the Edison Electric Illuminating Company, of Topeka, Kan., as an example of the most recent storage battery practice. This installation consists of 280 elements, each having a capacity of 640 amperes for one hour, and a booster set which controls the operation of the battery so that the generator load does not vary, even under extreme conditions, more than 2.5 per cent from any mean value for which the booster may be adjusted. The battery serves to equalize the loads arising from a 600-volt railway and motor system, a three-wire, 125-volt lighting system, and a 2,300-volt single-phase system supplyng power to lamps in the outlying districts. Several charts, which are reproduced, show that the plant is at all times operating under economical conditions and rendering satisfactory service.

INDUSTRIAL RAILWAYS.—Catalogue No. 0511 of the C. W. Hunt Company, West New Brighton, Staten Island, N. Y., is a neatly illustrated 64-page publication dealing with the "industrial" railway, which is built with a 21.5-in. gauge for use in manufacturing establishments. Every part is especially designed with the idea that a railway for this purpose is as much a "machine" as a "lathe," a "steam hammer," or a "loom," and requires the same care in design, and the same quality of machine work. The track is made up with steel cross ties securely riveted to the rails, and, with the switches, curves, crossings, and turn tables, is ready to lay when received from the manufacturers. The cars have running gears so arranged that they pass around a curve of 12-ft. radius as easily as a wagon turns a corner.

News of the Trade.

THE ROBINS CONVEYING BELT CO. has recently opened an office in the Frick Building, Pittsburg, Pa. Mr. G. R. Delamater, its resident engineer, is prepared to receive inquiries from the vicinity of Pittsburg relating to conveying and hoisting machinery.

THE ABNER DOBLE COMPANY, of San Francisco, announces that it has opened a branch in Los Angeles at 447 Pacific Electric Building. The company's business in the water wheel and machinery line had increased to such an extent that it became necessary to have better representation in the Southwest. The new branch will have for its field Southern California, Arizona and New Mexico and parts of Nevada and Mexico. Mr. L. Cummins will have charge of the office.

S. F. ALDEN & CO.—On December 1, S. F. Alden & Co., Rialto Building, San Francisco, Cal., celebrated the second anniversary of their organization. The company's business for the year increased threefold as compared with the year preceding, which was a very successful one. The largest single order secured was in the gas department, the contract calling for one gas holder of 1,000,000 cu. ft. In the railway department numerous sales were made, included among which were orders for the equipping of several electric railways with the protected rail bond made by the Mayer & Englund Co., of Philadelphia, Pa. In the electric light department the largest single order secured was for cedar poles, requiring four complete train loads to fill. This was the largest single order for long cedar poles for shipment by rail ever placed on the Pacific Coast.

COMMON BATTERY TELEPHONY.—We are advised by the Sterling Electric Company, of Lafayette, Ind., as follows, as to an important recent decision: "The United States Circuit Court of Appeals has handed down the decision in the suit of the Western Electric Company vs. The Galesburg Union Telephone Company, which suit involves the common battery multiple circuits known as the Fowler system, which is manufactured by the Sterling Electric Company, of Lafayette, Indiana; the Sterling Electric Company having defended these suits. The case has been fought very bitterly for the past three years, the first hearing being before Judge Siemans, of Milwaukee, in the United States Circuit Court, at Chicago, his decision being in favor of the Galesburg Union Telephone Company, or the Sterling Electric Company. The case was appealed to the United States Circuit Court of Appeals, where it was again bitterly fought, the Court handing down the decision January 26th, affirming Judge Sieman's opinion." The Sterling Company considers that this decision by a court of last resort places it in a unique position as to common battery multiple systems in the "Independent" field.

THE EAGLE ELECTRIC WORKS, Peoria, Ill., has increased its capital stock from $15,000 to $25,000.

THE PARKER BOILER COMPANY, of Philadelphia, Pa., has developed a new type of double-end steam boiler that promises to meet with favor for electric railway and lighting plants, several stations of the Philadelphia Rapid Transit Company having used this type for some time with excellent results.

SCHUSTER & RICHARDSON, electrical contractors of Freeport, Ill., have sold their business and transferred all contracts, tools, fixtures, etc., to the Ridgway Electric Company, which will finish up all uncompleted work contracted for by the former company. The Ridgway Electric Company began business two years ago. It recently moved into new quarters on Van Buren Street.

THE NATIONAL ENGINEERING CO., successor of McGrew & Bruning, consulting and construction engineers, Brunson Building, Columbus, O., has organized with a number of departments. Mr. F. C. Caldwell is the chief engineer of the electrical department, and Mr. E. A. Hitchcock of the mechanical.

BUFFALO TESTING LABORATORY.—The Buffalo Testing Laboratory has been incorporated at Buffalo, N. Y., for the purpose of furnishing expert engineering and chemical services to large industries, with offices at 702 Ellicott Square and a laboratory for physical, chemical and electrical work on East Ferry St. The president of the company is Mr. George A. Ricker, C. E., formerly representing the Pittsburg Testing Laboratory in Buffalo; Vice-President Prof. Nathaniel W. Shed, chemist and metallurgist of the Buffalo Foundry Company.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, 60 Wall St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. S. Barstow, 56 Pine St., New York City, and Portland, Ore.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, George B. Tripp, Colorado Springs, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary. J. I. Lyle, 39 Cortlandt St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, F. Fish, Rochester, N. Y. Next meeting, Buffalo, Jan. 16, 1906.

ELECTRIC SALESMEN'S ASSOCIATION. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF CANADA.. Secretary, J. A. Mann, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, second Thursday in March, 1906.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Frank S. Leach, Sedalia, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Net meeting, Cleveland, O., July 18, 1906.

NATIONAL-INTERSTATE TELEPHONE ASSOCIATION. Secretary, A. L. Tetu, Nashville, Tenn.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane. 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, N. Y. Next meeting, Elmira, N. Y., June, 1906.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 1142 Wells Building, Milwaukee, Wis. Next meeting, Milwaukee, Wis., third Wednesday in January, 1906.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, O.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, O.

OLD TIME TELEGRAPHERS AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, second Tuesday in May, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. B. Fairchild, Jr., 114 Liberty St., New York.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electrical Light Company, Middlebury, Vt.

WESTERN SOCIETY OF ENGINEERS, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

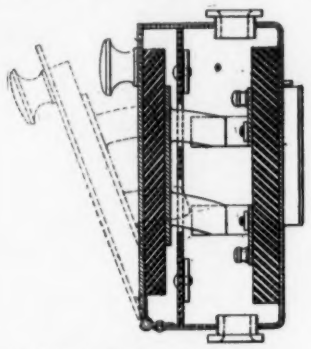
Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JAN. 23, 1906.

[Conducted by Rosebaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

810,384. ELECTRIC LAMP LIGHTER; Peter W. Arduino and Amedeo A. Arduino, Stamford, Conn. App. filed Apr. 22, 1904. A fine platinum wire is stretched across the surface of the wick and in circuit with a bi-chromate plunge battery, the zinc element of which can be depressed into the electrolyte by a plunger. The bi-chromate cell forms a part of the lamp base.

810,389. END CELL SWITCH; Joseph Bijur, New York, N. Y. App. filed Oct. 14, 1904. The contact arm is moved by a lead screw which has a planetary or differential gear connection with a continuously rotating motor. A magnet operated brake is operable to engage the



810,527.—Electrical Switch.

differential gear when desired and reverse the rotation of the lead screw.

810,444. ELECTRIC DRILL; Charles W. Theil, Milwaukee, Wis. App. filed June 1, 1903. The motor armature is co-axial with the drill casing and has an arm with a loose planetary gear thereon. This planetary meshes with a fixed internal gear and a corresponding differential gear fixed to the drill chuck.

810,473. ADAPTER FOR INCANDESCENT-LAMP SOCKETS; Samuel E. Doane, Cleveland, O. App. filed Mar. 27, 1905. An adapter for incandescent lamps comprising sleeves formed to receive the lamp base and having contact members to engage the contacts of the socket, one of said members being rotatable independently of the other.

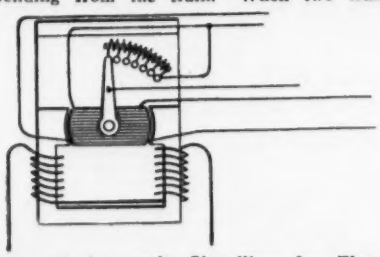
810,501. ELECTRIC FIRE ALARM AND THERMO INDICATOR; Alfred H. McNeil, Clapton, London, England. App. filed May 1, 1905. A slightly bent thermal strip has its end rigidly secured to a supporting block which carries a contact opposite the center of the thermal strip. This contact has a micrometer adjustment so as to vary the temperature for which the indicator operates.

810,536. TURNING SWITCH WITH LIGHTED HANDLE FOR ELECTRIC LINES; Hans Holzer, Frankfort-on-the-Main, Germany. App. filed Apr. 10, 1905. A pivotally mounted switch member for closing the circuit through the line contacts, said member having relatively long and short contact arms. Has a lamp in the switch hanndle connected with the line, and with an auxiliary contact in the path of the long arm of said switch member.

810,522. VOLTMETER SWITCH; George N. Eastman, Chicago, Ill. App. filed Apr. 26, 1905. The switch arms are geared to the operating handle by reduction gearing so that a slight movement of the handle causes a considerable movement of the switch arms. The purpose is to enable the readings of the different circuits to be made on the volt meter expeditiously, the rapid movement enabling a change of circuits before the volt-meter pointer has time to swing appreciably toward the zero reading.

810,527. ELECTRICAL SWITCH; Joseph F. George, New York, N. Y. App. filed Oct. 7, 1904. A protected switch particularly designed for theatres, etc., in which the usual knife blade arm has an insulating plate which forms the cover of a box surrounding the switch contacts.

810,560. ELECTRIC RAILWAY SIGNAL; Helen W. Parkes and Stella L. Vincent, Cleveland, O. App. filed Oct. 17, 1904. A pair of special trolley rails are laid along the track and contact with wheels or brushes depending from the train. When two trains are upon the



810,687.—System of Automatic Signalling for Electric Railways.

same block section alarm circuits are closed through the special trolleys to signals within the respective engine cabs.

810,596. SPRING-JACK WEDGE; Gustave A. Zundel, New York, N. Y. App. filed Nov. 17, 1904. Comprises metallic strips separated by an insulating body conducting wires being electrically connected with said strips and sewed to the body.

810,609. ELECTROFLUID PRESSURE MECHANISM FOR OPERATING RAILROAD APPLIANCES; Walter J. Bell, Los Angeles, Cal. App. filed Dec. 1, 1903. A fluid pump is located at the various switches and serves to continuously maintain pressure in a fluid reservoir. A pair of solenoids have poppet valve connections for opening and closing the pipes from said reservoir to the cylinder which operates the switch point, and the additional cylinder for the semaphore arm.

810,618. INSULATOR-CLAMP; Walter G. Clark, Seattle, Wash. App. filed Apr. 13, 1904. A wire strap has semi-circular portions adapted to embrace the usual groove of the insulator, and U-shaped uprights to engage the usual conductor and hold it in the insulator saddle. The device is drawn into clamping relation by a pair of split clamp nuts.

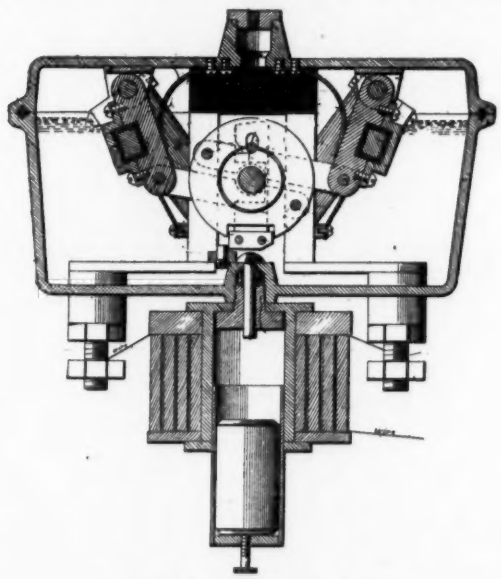
810,651. ELECTRIC GENERATOR FOR BICYCLES; Frank X. Hofbauer, West Orange, N. J. App. filed June 14, 1902. A small generator is pivoted to the frame of the bicycle and is normally held out of contact with the rear wheel by a detent. When the detent is released the generator falls by gravity so that its pulley contacts with the rear tire and is driven threby.

816,664. ATTACHMENT FOR ELECTRIC CONDUCTORS; David B. Mills, East Orange, N. J. App. filed Apr. 13, 1905. The extremity of the conductor from which the insulation has been removed is inserted through a hollow rivet in the bottom of a cap or ferrule, which rivet also serves to secure the usual terminal washer to the cap or ferrule.

810,687. SYSTEM OF AUTOMATIC SIGNALING FOR ELECTRIC RAILWAYS; Fitzhugh Townsend, New York, N. Y. App. filed Nov. 10, 1905. An inductive bond system in which the bonds for the separate rails have means for compensating for the effect of different currents therein by means of automatically varying the resistance of said bond in inverse proportion to the power current in the rails.

810,705. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; Abram L. Bower, Boyertown, Pa. App. filed Jan. 10, 1903. Details of a turn-out system having insulated track sections at the turn-outs which make circuits to set the signals alternately by means of a ratchet wheel which is intimately stepped around by an electro-magnet.

810,751. ELECTRIC CIRCUIT BREAKER; Frank O. Hartman, Mansfield, O. App. filed Apr. 6, 1903. The switch arms are brought to-



810,751.—Electric Circuit Breaker.

gether in an oil bath and are impelled apart by a powerful spring. A hammer operated detent serves to hold the switch arms together by a toggle jointed arrangement which gives a multiply effect so that a light blow of the solenoid core on the detent is effective to release the spring and separate the arms.

810,836. ELECTRIC-LIGHT FIXTURE; John F. Barrett and Nat C. Collins, Chicago, Ill. App. filed June 3, 1905. The lamp is supported by a flexible cord which depends from a spring drum within a casing. The drum has a pair of contact rings thereon through which the electric circuit is completed to the lamps.

810,841. MAGNETIC SEPARATOR; Henry F. Campbell, Melrose, Mass. App. filed July 29, 1902. The chute or tray has a flexible cover sheet extending over its surface through which the magnetic poles project. The purpose is to prevent the particles from attaching themselves to the sides of the pole pieces, and further to insure the distribution of the ore in a uniform thin layer on the tray.

810,855. MANHOLE FOR CONDUITS AND THE LIKE; Winfield A. Haller, New Orleans, La., and James W. Billingsley, Tivoli, N. Y. App. filed Feb. 21, 1905. The walls of the manhole have shelves with annular grooves on their surfaces. The shelves are located in a position to support the conductors or cables at their point of entrance through the walls, and serve to protect other cables in case of a burn-out of those above.

810,878. SELECTIVE CALL FOR TELEPHONES AND TELEGRAPHS; William Palmer, Jr., Rincon, N. Mex. App. filed July 18, 1902. Details of a magnet operated selective telephone arrangement having a ratchet wheel with a deep notch which varies in different instruments, and pallets for stepping around said ratchet wheel.

810,889. PROCESS OF ELECTROLYTICALLY PREPARING METALS OR ALLOYS FOR LITHOGRAPHIC PURPOSES; Otto C. Strecker, Darmstadt, Germany. App. filed May 12, 1902. A method of preparing lithographic surfaces which consists in painting the lithographic design on to the usual prepared zinc surface and then depositing a layer of metal on to the parts of the zinc not coated by the design so as to produce a water attracting, grease-repelling surface at such parts.